



Navigating trauma

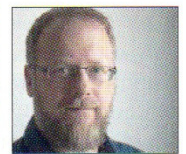
How PTSD affects spatial processing



As forces respond to growing numbers of officers suffering from PTSD, researchers from Bournemouth University explain how this condition can have a major impact on their ability to recall and reconstruct places in their minds.



Dr Jessica Miller developed the project in 2012. She has previously worked in critical incident personal support and preventing violent extremism, and at Bournemouth University has applied her research to trauma risk management and post-traumatic stress rehabilitation.



Dr Jan Wiener leads research on the psychological mechanisms underlying typical and atypical navigation and wayfinding behaviour.



Professor Sine McDougall is a cognitive psychologist who specialises in how we use cues for decision-making in complex environments.



Dr Sarah Thomas is a senior research fellow at Bournemouth University Clinical Research Unit with a background in psychology.

Navigating trauma

Police forces across the UK have to deal with the psychological impact of traumatic and critical incidents as part of daily life, and trauma risk management practices are in place to help teams to manage that impact. New neuropsychological research from Bournemouth University has now revealed that trauma exposure can impair individuals' ability to process spatial information – and this impairment may have implications for day-to-day working practices that call on situational awareness.

The good news is that for some, self-assessment tools can be used to identify impairment, and spatial processing techniques can be practiced to improve navigation performance- and perhaps even trauma resilience itself.

Media coverage of overseas military combat and of terrorist activity home and abroad has raised public awareness of the condition post-traumatic stress disorder (PTSD). However, what is less understood is that in reality, PTSD is

a psychological diagnosis that is only relevant to an estimated three per cent of the UK population (Breslau, JP Troost, K Bohnert, Z Luo, 2012). Nonetheless, with recent reports of increasing stress-related sickness absence in UK police forces, and with few precise figures for PTSD prevalence rates in occupations such as the police (Greenberg N, Brooks S, Dunn R, 2015), there are still many unknowns about the effect of trauma on individuals.

Cheryl Pinner is a former detective constable who has supported victims and their families through high trauma exposure, including acts of terrorism and child murder.

"Having worked for more than 30 years with people exposed to trauma, I have become very aware that with trauma, it's not a case of 'one-size-fits-all'," she explained.

"Each person portrays unique signs and symptoms and demonstrates unique feelings and needs. Although you can come to recognise the physical, emotional and visible effects of trauma, the effects may not always precisely fol-

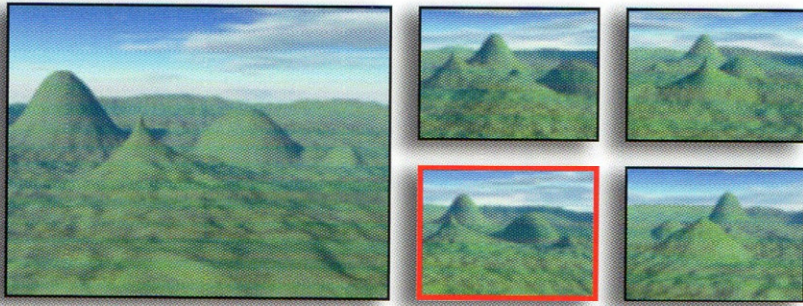


Figure 1 – the Four Mountains perspective taking task.

low what you'd expect from specific diagnostic criteria for PTSD. It would be helpful if more research looked at how trauma can affect the everyday lives of those who are healthy, not just those who develop post-traumatic stress."

New research conducted by Bournemouth University between 2012 and 2016 looked at the function of a specific area of the brain known to be involved in both trauma processing and spatial processing; the hippocampus

The four-year study aimed to ascertain whether trauma exposure influenced healthy individuals' cognition and behaviour, as well as PTSD.

Results showed for the first time that trauma exposure could affect how confident and capable healthy individuals (without PTSD) are at spatial processing and navigation. The findings go some way to explain why trauma management professionals and other trauma studies have reported individuals having navigation-related difficulties after traumatic experiences. Such difficulties have included driving response vehicles, navigating to new locations and learning the layout of new areas.

The study

One hundred and fifty individuals with trauma exposure from police forces, the military, the NHS and civilians took part in the study and were screened for trauma exposure and assessed for symptoms of PTSD. Participants completed a series of navigation questionnaires which assessed how confident they were finding their way around and which navigation 'styles' they were most likely to use.

Spatial processing was tested using a paper-based perspective taking task – the Four Mountains test (Hartley T,

Bird CM, Chan D, Cipolotti L, Husain M, Vargha-Khadem F, Burgess N 2007) – which involved memorising an image for ten seconds and then matching that image to one of four similar variations of it (figure 1). Navigation performance and strategy use (or 'style') was assessed in a virtual environment navigation task, called the 'alternative route' paradigm (Wiener JM, de Condappa O, Harris MA and Wolbers T, 2013). The paradigm required participants to learn a route and to build a map of the area in their mind so that they could use this map to navigate when tested on that route. A particular challenge of this task was to join the learnt route from different directions to the direction in which it was learnt (Figure 2).

Results

Healthy individuals with experience of trauma (who did not have PTSD) were significantly worse at any navigation that relied on building a mental map of the environment, compared to healthy individuals who had no experience of trauma. This means that in practice, healthy individuals with previous trauma exposure could experience difficulties being accurate when, for example, creating a 'floor plan' of a building or crime scene, or to constructing an aerial view of a network of streets or roads in a neighbourhood.

On a more positive note, the study showed that healthy participants who had previous trauma experiences were very self-aware of how competent they were at navigation – indeed, more self-aware than those without experience of trauma. This means that self-reported competence in navigation may be a reliable measure of navigation performance in healthy personnel with trauma experience and therefore means that simple navigation questionnaires could help identify any negative impact of trauma exposure on spatial processing.

Compared to healthy participants, those with probable or clinical level PTSD were not reliable in their self-reported navigation competence. Experiments revealed that PTSD impaired spatial processing in perspective taking and route learning in all active navigation and confirms findings from other recent studies (Smith K, Burgess N, Brewin CR and King JA, 2015, *Neurobiology of Learning and Memory*). Their impairment was explained by the fact that those with

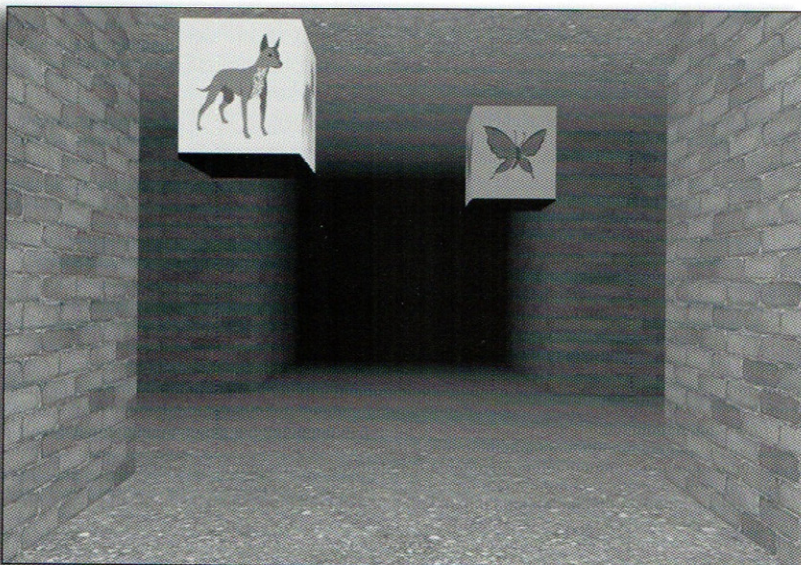
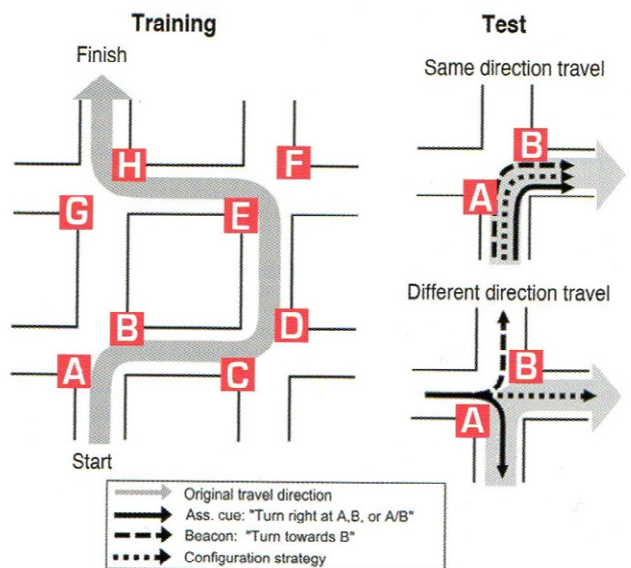


Figure 2 – the 'alternative route' navigation paradigm.



PTSD had an 'associative bias' in their thinking and they transferred this bias to their actual navigation behaviour.

The consequence of this bias was that individuals with PTSD typically relied on making associations between landmarks and turns according to the direction they were facing, and were unable to construct a mental map of where they were in time to navigate correctly.

Implications

In healthy, trauma exposed individuals, basic spatial processing skills may be intact but there may be some disruption to more challenging navigation activities which call on the hippocampus. Examples of hippocampal dependent activities that may be at risk include those involving:

- Aerial views, satellite imagery and Ordnance Survey maps of routes or topography;
- Floor plans, overhead views and 3D representation of crime scenes or traffic collisions; and
- Navigating without the assistance of satellite navigation in new environments and areas.

Again, the good news is that the 2016 study also showed that healthy trauma-exposed individuals have good self-awareness of how they navigate and how well they navi-

This increasing body of evidence from neuroscientific trauma research takes the emergency services one step closer to understanding some of the more subtle impacts of trauma exposure.

gate. So, developing navigation questionnaires to detect the impact of trauma on navigation may prove a useful tool in the future.

For those who are experiencing PTSD symptomology (diagnosed or undiagnosed), the picture was less positive. Self-assessment was not reliable for those with PTSD and it is likely that individuals diagnosed with the condition may not realise that they are navigating with significant impairment. Given that having PTSD significantly impaired performance in all spatial processing and active navigation tasks in this study – and some in previous studies (Smith K, Burgess N, Brewin CR and King JA, 2015, *Neurobiology of Learning and Memory*; Tempesta D, Mazza M, Iaria G, De Gennaro L, and Ferrara M, 2011) – these findings emphasise the importance of assessing serving officers for probable or clinical levels of PTSD, particularly for those who undertake regular responsibilities requiring spatial processing and active navigation.

More good news is that this study builds on established research, which has demonstrated that most individuals are capable of improving their spatial processing and navigation. A famous study of London taxi drivers in 2002 (Maguire EA, Gadian DG, Johnsrude IS, Good CD, Ashburner J, Frackowiak RS, et al, 2000) revealed that individuals can physically 'grow' this area of the brain used for spatial trauma processing (the hippocampus) by practicing building mental maps of their environment and using these maps to learn alternative routes to new destinations. This means that many of us can improve our spatial processing and navigation even just by turning off our satnav and by actively learning new routes and creating mental maps of where we are.

Recommendations

So what does this study mean for UK police forces? The BU study (2016) demonstrates for the first time that trauma exposure has a significant and measurable impact on individuals' ability to navigate and process spatial information, regardless of PTSD. The findings highlight the need for trauma exposure to be monitored for its potential hidden impact on healthy individuals, as well as for those who develop PTSD symptomology. Results also suggest that performance in the police in areas that require spatial processing or navigation could be improved by:

- Accurate navigation performance assessment and self-assessment in specific job roles;
- Commitment to trauma risk management (TRiM) assessment; and
- Measures to encourage individuals to practice spatial processing and navigation in specific job roles after trauma exposure.

Simon Megicks, a temporary assistant chief constable at Hertfordshire Constabulary, was one of the 150 participants for the research. He explained: "Having taken part in the study myself, I can see just how demanding spatial processing can be and how relevant this is to so many areas of policing, from crime scene analysis and traffic collision investigation to the roles of helicopter pilots and air crew observers... the study raises important issues for assessment and performance, which is worthy of consideration in the wider context of trauma risk management."

This increasing body of evidence from neuroscientific trauma research takes the emergency services one step closer to understanding some of the more subtle impacts of trauma exposure on individuals, impacts which may have otherwise gone unspoken and unnoticed.

Detective Constable Jane Naylor of Greater Manchester Police has supported victims, witnesses and their families who have experienced trauma.

"Hearing about this research has resonated with some of the personal experiences I and my colleagues have had in terms of travel anxiety and behaviour; experiences I would never have thought had a scientific explanation. I am hopeful that more can be done to factor in the impact of trauma on navigation in trauma risk management... and to encourage individuals to look after their brains," she said.

The next direction for this research is to consider if practicing spatial processing techniques can improve performance in specific job roles that require situational awareness and also to determine if these techniques can actually help individuals and teams process trauma following critical incidents.

Dr Ian Hesketh, senior policy adviser at the College of Policing, said: "The implications of this research for the wellbeing of all police officers and staff are clear; none more so than for those who undertake roles requiring competence in situational awareness and spatial processing.

"The study is a welcome contribution to the evidence-based approach we seek in professionalising the service. The research will also feed into the National Police Chiefs' Council Wellbeing and Engagement Working Group to inform our PTSD responses, and in support of police training, assessment and trauma risk management practices."

■ If you would like to be involved in the development and application of this research or would like more information, contact Dr Jessica K. Miller at millerj@bournemouth.ac.uk or Jessica.miller@cantab.net.

• The research was also conducted under the clinical supervision of Professor Chris Brewin (University College London) and in consultation with Professor Sir Simon Wessely (Combat Stress and the King's Centre for Military Health Research).