EMDR therapy: crucial processes and effectiveness in a non-clinical and a post-war, cross-cultural context.

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Declaration

I declare that this thesis is my own account of my research and contains as its main content work that has not previously been submitted for a degree at any tertiary education institution.

Ethics approval was granted through The Murdoch University Human Research Ethics Committee (permit numbers: chapter 3: 2008/052; chapters 4 and 5: 2011/013). Research presented in chapters 4 and 5 was also approved by the Cabinet of Health Research and Development under the Ministry of Health in Timor Leste, and this research was registered with Australia and New Zealand Clinical Trials Registry (ANZCTR): 12611000239965.

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A note on formatting and style

This PhD thesis comprises a number of published research papers. These articles are incorporated into the thesis along with additional text that has been provided to introduce and link the published work. It is hoped that the final amalgamation allows for the development of a cohesive body of research that can be easily followed.

As the articles are reproduced from their published form (chapters 2, 3, 4, 5, and Appendix A), this accounts for some repetition and minor inconsistencies in Anglo/American spelling within the thesis.

Dedication

This thesis is dedicated to the memory of

Derek Hailes-MacDonald

who taught me to listen, to the voices that are seldom heard.

Acknowledgements

> If I have seen even a little further it is by standing on the shoulders of Giants! We see more and farther than our predecessors, not because we have keener vision or greater height, but because we are lifted up and borne aloft on their gigantic stature. – Isaac Newton.

No thesis comes together without the help and support of others. Therefore I would like to acknowledge those who contributed directly and indirectly throughout this PhD.

First and foremost I would like to thank my primary supervisor, Dr Christopher Lee, and my secondary supervisor, Professor Peter Drummond. Together they provided guidance, a wealth of knowledge for me to learn from, with invaluable expertise and experience in areas of both applied clinical and academia. Both have generously given seemingly endless support. Together they have provided the perfect balance of challenging and aiding in ideas coming to life, knowing depth of literature and theory, and offered balanced and unbiased views to a body of literature in a field that may at times be biased. They provided a mix of supervisory and teaching excellence with a grounded, human, modest way of helping this thesis evolve. I thank them wholeheartedly for their patience, kindness, and generously giving their time.

Thank you also to friends and colleagues for support over this period in my life. Thank you to Jeanette Lynch for always being positive, encouraging self care, and for making me laugh and smile at the small, yet important stuff in life! My thoughts of gratitude are also with Derek Hailes-McDonald, who sadly left this life during the writing of this thesis. Derek was always, realistic, genuinely caring, and taught me lessons in balancing work, research, friends and family, and the joyful things that matter most in life. He helped me find confidence when needed, but taught me the importance of modesty and silence. You truly led by example. Your words still guide me daily.

I would like to thank all those involved with all aspects of the research in Timor Leste. Thank you also to the anonymous peer reviewers of each publication who offered valuable, insightful, and thoughtful feedback and corrections throughout each publication process.

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Abstract

The aim of this thesis was to clarify mechanisms that contributed to the treatment of adult posttraumatic stress disorder (PTSD) with eye movement desensitization and reprocessing therapy (EMDR). An initial review highlighted that: EMDR is efficacious for treatment of PTSD; the processes in EMDR differ from other PTSD treatments; controversy remained about the necessity and role of the eye movement (EM) component; and although the underlying mechanisms of EMDR remained unclear, evidence was emerging supporting orienting response, REM-sleep, and working memory theories of EMDR.

The first study in this thesis investigated the necessity of EMs in EMDR, and the psychophysiological correlates of EM tasks used during therapy. Sixty-two non-clinical participants with negative autobiographical memories received a single EMDR session either without EMs, or with EMs of either varied or fixed rate of speed. EMDR-with-EMs led to greater reduction in distress than EMDR-without-EMs. Physiologically, when EMs began heart rate decreased significantly; skin conductance decreased during EM sets; heart rate variability and respiration rate increased significantly as EMs continued; and orienting responses were more frequent in the EM than no-EM condition at the start of exposure. Findings indicated that the eye movements in EMDR were beneficial, and were coupled with distinct psychophysiological changes that aid memory processing.

A following study confirmed these findings by examining the effectiveness and physiological correlates of EMDR to treat trauma symptoms in a real world, post-war/conflict, developing nation, Timor Leste. Participants were 23 Timorese adults with symptoms consistent with PTSD, who served as their own waitlist control. EMDR was followed by significant and large reductions in PTSD symptoms, depression, and anxiety. Physiological responses associated with therapy confirmed changes seen previously in Western treatment sessions; physiological dearousal occurred within desensitisation sessions; heart rate decreased as EM sets began; skin conductance decreased within EM sets; and skin conductance responses that habituated in size and number in EM sets characteristic of an orienting response. Findings demonstrate EMDR can be effectively used cross-culturally, post-war/conflict, in Timor Leste, and this research adds to the body of theoretical knowledge as to how EMDR therapy works to facilitate processing of trauma memories.

List of Original Publications

This thesis comprises the following publications:

Chapter 2.   Schubert, S. & Lee, C. (2009). Adult PTSD and its treatment with EMDR: A review of controversies, evidence, and theoretical knowledge. *Journal of EMDR Practice and Research, 3*, 117-132. doi: 10.1891/1933-3196.3.3.117

Chapter 3.   Schubert, S. J., Lee, C. W., & Drummond, P. D. (2011). The efficacy and psychophysiological correlates of dual-attention tasks in eye movement desensitization and reprocessing (EMDR*). Journal of Anxiety Disorders, 25*, 1-11. doi: 10.1016/j.janxdis.2010.06.024

Chapter 4.   Schubert, S. J., Lee, C. W., de Araujo, A., Butler, S. R., Taylor, G., & Drummond, P. D. (2016). The effectiveness of eye movement desensitization and reprocessing (EMDR) to treat symptoms following trauma in Timor Leste. *Journal of Traumatic Stress*, *29,* 141-148. doi: 10.1002/jts.22084

Chapter 5.   Schubert, S. J., Lee, C. W., & Drummond, P. D (2016). Eye movements matter, but why? Confirmatory psychophysiological correlates of EMDR to treat trauma in Timor Leste. *Journal of EMDR Practice and Research, 10,* 70-81. doi: 10.1891/1933-3196.10.2.1

Appendix A.   Lee, C.W. and Schubert, S.J (2009). Omissions and errors in the Institute of Medicine's report on scientific evidence of treatment for posttraumatic stress disorder. *Journal of EMDR Practice and Research, 3,* 32-38. doi: 10.1891/1933-3196.3.1.32

Statement of author contributions in publications

There is a statement of contribution of others prior to each chapter in this thesis that presents publications. The statement specifies the extent to which the original research was undertaken by me, the extent to which I authored the work, and the estimated proportion of the work that was done by me. The specific contribution of work by others is acknowledged.

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List of Abbreviations

ACPMH	Australian Centre for Posttraumatic Mental Health
APA	American Psychiatric Association
AIP	adaptive information-processing
CBT	cognitive behaviour therapy
EM(s)	eye movement(s)
DSM	diagnostic and statistical manual of mental disorders
EMDR	eye movement desensitisation and reprocessing
GSR	galvanic skin response
HTQ	Harvard trauma questionnaire
HR	heart rate
HRV	heart rate variability
HSCL	Hopkins symptom checklist
ICD	International Classification of Disease
NICE	National Institute for Clinical Excellence (UK)
OR	orienting response
PE	prolonged exposure
PTSD	posttraumatic stress disorder
RCT	randomised controlled trial
RR	respiration rate
SC	skin conductance
SCR	skin conductance response
SUDs	subject unit of distress
µmho	micro mho
VAM	verbally accessible memory
SAM	situationally accessible memory
PL	phonological loop
VSSP	visual spatial sketch pad
CE	central executive
WHO	World Health Organisation
WM	working memory
WMC	working memory capacity

Dissemination of research and awards

Conference presentations

Schubert, S. (Sept. 2012). The effectiveness and underlying mechanisms of eye movement desensitization and reprocessing (EMDR) to treat symptoms consistent with posttraumatic stress disorder (PTSD) in Timor Leste. Presentation at the 17th Australasian Conference on Traumatic Stress, Perth, Australia.

Schubert, S. (2010, June). The efficacy and psychophysiological correlates of dual-attention tasks in eye movement desensitisation and reprocessing (EMDR). Presentation at the first EMDR Asia Conference, Bali, Indonesia.

Schubert, S. (2009, June). The efficacy and psychophysiological correlates of dual-attention tasks in eye movement desensitisation and reprocessing (EMDR). Poster presented at the 10th European Conference, Amsterdam, Netherlands.

Media presentations of research

Rodriquez, T. (2013). Can Eye Movements Treat Trauma? Recent research supports the effectiveness of "eye movement desensitization and reprocessing". *Scientific American.* Retrieved from http://www.scientificamerican.com/article/can-eye-movements-treat-trauma/
(See Appendix B for a reproduction of this article).

Rasdien, P. (2011, January 19). The eyes have it in trauma therapy. *The Western Australian,* section: health, p. 7.
(See Appendix C. for a reproduction of this article).

Oshanek, R. (2009, 4th December). Rapid eye movements help victims overcome trauma. Science Network Western Australia. Retrieved from http://www.sciencewa.net.au/topics/health-a-medicine/item/632-rapid-eye-movements-help-victims-overcome-trauma

Awards

2012 – Australian Psychological Society College of Clinical Psychologists Student prize.

2009 - Award for best research poster at the 10th EMDR Europe Conference, Amsterdam.

Chapter 1   General Introduction

"What we know is a drop. What we don't know is an ocean." - Isaac Newton

"All human knowledge takes the form of interpretation." – Walter Benjamin

"The beginning of knowledge is the discovery of something we do not understand." – Heraclitus

In 2008 the Institute of Medicine (IOM) (IOM, 2008) released a report that presented an examination of the evidence for psychotherapeutic and pharmacological treatments for posttraumatic stress disorder (PTSD). This report was commissioned in 2007 by the US Department of Veteran Affairs (DVA) to assess the scientific evidence on treatment modalities for PTSD. The IOM (2008) report concluded that "the evidence is inadequate to determine the efficacy of EMDR in the treatment of PTSD" (p. 112). At the time, this conclusion was inconsistent with the body of scientific literature on the evidence for the efficacy of EMDR therapy (Bisson et al., 2007; Bradley, Greene, Russ, Dutra, & Westen, 2005; Davidson & Parker, 2001; Van Etten & Taylor, 1998), and was at odds with prior international reviews and practice guidelines that recommended the use of EMDR and exposure therapy for the treatment of PTSD (Australian Centre for Posttraumatic Mental Health (ACPMH), 2007; American Psychiatric Association (APA), 2004; Bleich, Kotler, Kutz, & Shalev, 2002; Dutch National Steering Committee, 2003; Foa, Keane, & Friedman, 2000; National Institute for Clinical Excellence (NICE), 2005).

A critical review of the basis for this conclusion revealed errors in the report that appeared to explain their disparate conclusion. Findings of key studies that reported positive outcomes for EMDR were misrepresented, numerous positive studies were excluded without apparent justification, and the report failed to consider several published studies that reported benefits for EMDR when used to treat PTSD (Lee & Schubert, 2009). The report presented policy makers and practitioners with misinterpreted, and partial presentation of existing scientific information. Thus, a response to the IOM (2008) report was written by Lee and Schubert (2009) (see appendix A), and from insights gained whilst writing this paper the research studies in this PhD thesis were planned.[i]

The overall aim of this thesis was to clarify mechanisms that contributed to the treatment of adult PTSD with EMDR therapy. Research in this thesis examined the effectiveness and underlying mechanisms of EMDR therapy when used to treat negative autobiographical memories in a non-clinical Australian population, and PTSD symptoms in a Timorese population in a real world clinical setting in Timor Leste.

Inspired by the misrepresentation of EMDR literature in the IOM (2008) report, the initial aim of this thesis was to provide a critical overview of selective issues, controversies, evidence, and theoretical knowledge in regards to what was currently known and unknown about PTSD and its treatment with EMDR therapy (Schubert & Lee, 2009). This article is presented in chapter 2 and was the opening article for a special edition of the Journal of EMDR Research and Practice that acknowledged 20 years of EMDR research following Shapiro's (1989) publication of the first EMDR randomized controlled treatment trail (RCT). It was also in 1989 that the first RCTs on trauma-focused cognitive behavioural therapy (CBT) (Keane, Fairbank, Caddell, & Zimering, 1989) and psychodynamic therapy for PTSD (Brom, Kleber, & Defares, 1989) were published.

Chapter 2 begins with an historical overview of PTSD and predominant theories of PTSD are summarized. The ongoing debate regarding the validity of PTSD as a diagnosis, and the aetiology of PTSD is also discussed. Post publication of chapter 2, PTSD criteria were revised by both classification systems - the DSM-IV-TR (APA, 2000) and the International Classification of Diseases and Related Health Problems Tenth Revision (ICD-10; World Health Organisation [WHO], 1992). To set the context for the research presented in this thesis in which PTSD symptoms are treated using EMDR therapy, the implications of the revised diagnostic criteria on PTSD prevalence, theory, and treatment will be discussed. For all research in this thesis, however, assessments that reflected DSM-IV-TR (APA, 2000) PTSD criteria were used to identify PTSD symptoms as data was collected prior to DSM-5 (APA, 2013) publication.

PTSD diagnostic criteria: an ongoing debate

In May 2013, the American Psychiatric Association (APA, 2013) released DSM-5 with revised, broader PTSD criteria. In contrast, a more narrow definition of PTSD criteria was proposed for the ICD-11, with a planned release in 2018 (Maercker et al., 2013; WHO, 2015). Table 1 presents comparative changes for PTSD criteria from DSM-IV-TR to DSM-5, and Table 2 outlines comparative changes from ICD-10 (WHO, 1992) to the proposed ICD-11.[ii]

Table 1.

Comparison of DSM-IV-TR criteria for PTSD to DSM-5 criteria.

DSM-IV-TR Criteria	DSM-5 Criteria
A. The person has been exposed to a traumatic event in which both of the following were present: 1. The person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others. 2. The person's response involved intense fear, helplessness, or horror.	A. Exposure to actual or threatened death, serious injury, or sexual violence, in one (or more) of the following ways: 1. Directly experiencing the traumatic event(s). 2. Witnessing, in person, the event(s) as it occurred to others 3. Learning that the traumatic event(s) occurred to a close family member or close friend. In such cases, the event(s) must have been violent or accidental. 4. Experiencing repeated or extreme exposure to aversive details of the traumatic event(s) (e.g., first responders collecting human remains; police officers repeatedly exposed to details of child abuse). Note. This does not apply to exposure through electronic media, television, movies, or pictures, unless this exposure is work related.
B. The traumatic event is persistently reexperienced in one or more of the following ways: 1. Recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions. 2. Recurrent distressing dreams of the event. 3. Acting or feeling as if the traumatic event were recurring (flashbacks). 4. Intense psychological distress at exposure to internal or external cues that symbolize or represent an aspect of the traumatic event. 5. Physiological reactivity on exposure to internal or external cues that symbolize or represent an aspect of the traumatic event.	B. Presence of one (or more) of the following intrusion symptoms associated with the traumatic event(s), beginning after the traumatic event(s) occurred: 1. Recurrent, involuntary, and intrusive distressing memories of the traumatic event(s). 2. Recurrent distressing dreams in which the content and/or affect of the dream are related to the traumatic event(s). 3. Dissociative reactions (e.g., flashbacks) in which the individual feels or acts as if the traumatic event(s) were recurring. (such reactions may occur on a continuum, with the most extreme expression being a complete loss of awareness of present surroundings.) 4. Intense or prolonged psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event(s). 5. Marked physiological reactions to internal or external cues that symbolize or resemble an aspect of the traumatic event(s).
C. Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before the trauma), as indicated by three or more of the following: 1. Efforts to avoid thoughts, feelings, or conversations associate with the trauma. 2. Efforts to avoid activities, places, or people that arouse recollections of the trauma. 3. Inability to recall an important aspect of the trauma. 4. Markedly diminished interest or participation in significant activities. 5. Feeling of detachment or estrangement from others. 6. Restricted range of affect. 7. Sense of foreshortened future.	C. Persistent avoidance of stimuli associated with the traumatic event(s), beginning after the traumatic event(s)), as evidenced by one or both of the following: 1. Avoidance of or efforts to avoid distressing memories, thoughts, or feelings about or closely associated with the traumatic event(s). 2. Avoidance of or efforts to avoid external reminders (people, places, conversations, activities, objects, situations) that arouse distressing memories, thoughts, or feelings about or closely related with the traumatic event(s).

Source: Calhoun et al., 2012, Modified with permission

Table 1. Continued ...

Comparison of DSM-IV-TR criteria for PTSD to DSM-5 criteria.

DSM-IV-TR Criteria	DSM-5 Criteria
	D. Negative alterations in cognitions and mood associated with the traumatic event(s) beginning or worsening after the traumatic event(s) occurred, as evidenced by two (or more) of the following: 1. Inability to remember an important aspect of the traumatic event(s) (typically due to dissociative amnesia and not to other factors such as head injury, alcohol, or drugs). 2. Persistent and exaggerated negative beliefs or expectations about oneself, others, or the world. (e.g., "I am bad," "No one can be trusted," "The world is completely dangerous." "My whole nervous system is completely ruined"). 3. Persistent, distorted cognitions about the cause or consequences of the traumatic event(s) that led the individual to blame himself/herself or others. 4. Pervasive negative emotional state (e.g., fear, horror, anger, guilt, or shame). 5. Markedly diminished interest or participation in significant activities. 6. Feelings of detachment or estrangement from others. 7. Persistent inability to experience positive emotions (e.g., inability to experience happiness, satisfaction, or loving feelings).
D. Persistent symptoms of increased arousal (not present before the trauma), as indicated by two or more of the following: 1. Difficulty falling or staying asleep. 2. Irritability or outbursts of anger. 3. Difficulty concentrating. 4. Hypervigilance. 5. Exaggerated startle response.	E. Marked alterations in arousal and reactivity associated with the traumatic event(s). Beginning or worsening after the traumatic event(s) occurred, as evidenced by two (or more) of the following: 1. Irritable behaviour and angry outbursts (with little or no provocation) typically expressed as verbal or physical aggressions toward people or objects. 2. Reckless or self-destructive behavior. 3. Hypervigilance. 4. Exaggerated startle response. 5. Problems with concentration. 6. Sleep disturbance (e.g., difficulty falling or staying asleep, or restless sleep).

Source: Calhoun et al., 2012, Modified with permission

Table 2.

Comparison of ICD-10 criteria for PTSD to proposed ICD-11 criteria

ICD-10 criteria	Proposed ICD-11 criteria

Parent: Neurotic, stress-related and somatoform disorders.
F43 Reaction to severe stress, and adjustment disorders
 	
F43.1 Post-traumatic stress disorder
 	
A. The patient must have been exposed to a stressful event or situation (either short or long-lasting) of exceptionally threatening or catastrophic nature, which would be likely to cause pervasive distress in almost anyone.
 	
B. There must be persistent remembering or 'reliving' of the stressor in intrusive 'flashbacks', vivid memories, or recurring dreams, or in experiencing distress when exposed to circumstances resembling or associated with the stressor.
 	
C. The patient must exhibit an actual or preferred avoidance of circumstances resembling or associated with the stressor, which was not present before exposure to the stressor.
 	
D. Either of the following must be present:
  1. inability to recall, either partially or completely, some important aspects of the period of exposure to the stressor
  2. persistent symptoms of increased psychological sensitivity and arousal (not present before exposure to the stressor), shown by any two of the following:
    a. difficulty in falling or staying asleep
    b. irritability or outbursts of anger
    c. difficulty in concentrating
    d. hypervigilance
    e. exaggerated startle response.
 	
E. Criteria B, C, and D must all be met within 6 months of the stressful event or the end of a period of stress. (For some purposes, onset delayed more than by 6 months may be included, but this should be clearly specified.)
 	
The late chronic sequelae of devastating stress, i.e. those manifest decades after the stressful experience, should be classified under F62.0 [enduring personality changes].
 	
Includes: traumatic neurosis
	Parent: Disorders specifically associated with stress
	
	7B20 Post-traumatic stress disorder
	
	Definition: Post-traumatic stress disorder (PTSD) is a disorder that may develop following exposure to an extremely threatening or horrific event or series of events characterized by reexperiencing the traumatic event or events in the present in the form of vivid intrusive memories, flashbacks, or nightmares, typically accompanied by strong and overwhelming emotions such as fear or horror, and strong physical sensations, avoidance of thoughts and memories of the event or events, or avoidance of activities, situations, or people reminiscent of the event or events, and persistent perceptions of heightened current threat, for example as indicated by hypervigilance or an enhanced startle reaction to stimuli such as unexpected noises. The symptoms must last for at least several weeks and cause significant impairment in functioning.
	
	Inclusions: Traumatic neurosis
	
	Exclusions: Acute stress reaction (7B26); Complex post-traumatic stress disorder (7B21)
	
	7B21 Complex post-traumatic stress disorder
	Parent: Disorders specifically associated with stress
	Definition: Complex post-traumatic stress disorder (Complex PTSD) is a disorder that may develop following exposure to an event or series of events of an extreme and prolonged or repetitive nature that is experienced as extremely threatening or horrific and from which escape is difficult or impossible (e.g., torture, slavery, genocide campaigns, prolonged domestic violence, repeated childhood sexual or physical abuse). The disorder is characterized by the core symptoms of PTSD; that is, all diagnostic requirements for PTSD have been met at some point during the course of the disorder. In addition, complex PTSD is characterized by 1) severe and pervasive problems in affect regulation; 2) persistent beliefs about oneself as diminished, defeated or worthless, accompanied by deep and pervasive feelings of shame, guilt or failure related to the stressor; and 3) persistent difficulties in sustaining relationships and in feeling close to others. The disturbance causes significant impairment in personal, family, social, educational, occupational or other important areas of functioning.
	
	Inclusions: Personality change after: concentration camp experiences; Personality change after: disasters; Personality change after: prolonged: captivity with an imminent possibility of being killed; Personality change after: prolonged: exposure to life-threatening situations such as being a victim of terrorism; Personality change after: torture
	
	Exclusions: Post-traumatic stress disorder (7B20)

With DSM-5 (APA, 2013) publication the main changes in PTSD criteria were that the definition of what constituted a stressor became more explicit in an attempt to further define what constitutes a traumatic event and to clarify how an individual experienced it. In contrast, ICD-11 proposed a general definition of a traumatic stressor as "an extremely threatening or horrific event", with the diagnosis focusing more on the symptom presentation of the core elements of re-experiencing, avoidance of reminders, and perceptions of heightened current threat, and arousal (Maerker et al., 2013). In DSM-5 the criterion A2 (the experience of fear, helplessness or horror) was removed. The APA subcommittee decided that it had insufficient clinical utility. The 17 symptoms from DSM-IV-TR remained, but in DSM-5 three were added. Whereas DSM-IV presented three symptom clusters - reexperiencing, avoidance/numbing, and arousal – DSM-5 has 4, with the avoidance/numbing cluster divided into avoidance *and* persistent negative alterations in cognitions and mood. Confirmatory factor analyses indicated that the new 4 factor symptom structure in DSM-5 provided better fit to the data than the DSM-IV 3-factor model (Friedman, Resick, Bryant, & Brewin, 2011; Maestas, Benge, & Pastorek, LeMaire, & Darrow, 2011; Stein et al., 2014).[iii]

Prevalence of PTSD: DSM-IV estimates

Estimates of prevalence depend not only on the amount and type of exposure to potentially traumatic events in the general community being examined, but also on diagnostic criteria and sampling methods used. Thus, an implication of changing diagnostic boundaries is a change in estimated prevalence rates.

In Australia and the US, large community surveys (Kessler, Sonnega, Hughes, & Nelson, 1995; Creamer, Burgess, & McFarlane, 2001) indicate that 50-65% of people report to have experienced at least one potentially traumatic event in their lives, with many reporting 2 or more experiences. Lifetime prevalence rates for PTSD in adults in the USA have been at 6.8% - 7.3% using DSM-IV criteria (Harvard Medical School, 2007; Roberts, Gilman, Breslau, Breslau, & Koenen et al., 2011). Reports of 12 month prevalence of PTSD (percentage of the population who have had PTSD in the past year) are estimated to be 3.9% in the USA (Narrow, Rae, Robins, & Regier, 2002) and 1.3% in Australia (Creamer, Burgess, & McFarlane, 2001), with Australia's lifetime prevalence estimated to be twice this figure.

Globally, PTSD prevalence varies from country to country. For example, according to The European Study of the Epidemiology of Mental Disorders Survey (Demyttenaere et al., 2004), lifetime prevalence for PTSD in Western European countries ranged from: 2.2% in Spain (Olaya et al., 2014); 2.4% in Italy (Carmassi et al., 2014); 3.9% in France (Husky, Lepine, Gasquet, & Kovess-Masfety, 2015); 5.6% in Sweden (Frans, Rimmo, Aberg, & Frederickson, 2005); and a high 8.8% in Northern Ireland (Ferry et al., 2014). Cross-culturally PTSD

prevalence rates are considerably lower in countries such as China, Japan, and South Africa with 12-month community prevalence rates of 0.2%, 0.4%, and 0.6%, respectively (Kawakami et al., 2005; Shen et al., 2006; Williams et al., 2008). On the other hand, rates of PTSD are much higher in post-conflict settings. In a study that comparatively examined PTSD in 4 post-conflict settings community-based PTSD rates were reported to be 37% in Algeria, 28% in Cambodia, 16% in Ethiopia, and 18% in Gaza (De Jong et al., 2001).

In post-conflict Timor Leste, however, a survey on current rates of PTSD in 2008 (Silove et al., 2008) revealed a comparatively low point prevalence estimate of 1.47% based on the Structured Clinical Interview for DSM-IV (SCID: First, Spitzer, Gibbon, & Williams, 1997). An initial screen in this survey revealed a higher point prevalence estimate of 7.0% using The Harvard Trauma Questionnaire (HTQ; Mollica, Caspi-Yavin, Bollini, Truong, Tor, & Lavelle, 1992). Comparatively, in the immediate aftermath of the 1999 emergency in Timor Leste an estimate of PTSD in the community using the HTQ was 34% (Modvig et al., 2000). Perhaps the passing of time between these two studies allowed acute PTSD symptoms to remit in many members of the population, but the prevalence rates estimated in Timor Leste by Silove and colleagues in 2008 are surprisingly low as high rates of torture (57%) were experienced during times of conflict (Modvig et al., 2000). By contrast, 20% of tortured and imprisoned Tibetan refugees (Crescenzi et al., 2002) and 59.7% of torture survivors in rural Nepal had PTSD (Tol et al, 2007). The experience of trauma in East Timor is discussed in Chapter 5.

Prevalence of PTSD: DSM-5 and ICD-11 estimates

Following the release of DSM-5 (2013) Kilpatrick et al. (2013) compared prevalence rates of PTSD defined according to DSM-IV (APA. 1994) and DSM-5 (APA, 2013) using a national US nonclinical sample of 2953 adults that were recruited online. Prevalence rates indicated that DSM-5 estimates were lower than DSM-IV (i.e. lifetime prevalence for DSM-5 was 8.3% compared to DSM-IV, 9.8%). Authors reported the lower DSM-5 estimates to be due to tightening of criteria A for indirect exposure, removal of criterion A2, and the new requirement of an active avoidance symptom. Using the same sample, in addition to a convenience sample of US military veterans, Miller and colleagues (2013) found similar PTSD lifetime prevalence rates using DSM-IV (16.4%) and DSM-5 (16.6%).

Comparable current PTSD prevalence rates for DSM-IV (5.9%) and DSM-5 (6.7%) were also reported in recent study of 510 injury patients assessed 72 months posttrauma (O'Donnell et al., 2014). In this study, the current PTSD prevalence rate using the proposed ICD-11 criteria was significantly lower than the ICD-10 rate (3.3% vs 9.0%). Comparing the diagnostic systems, the ICD-11 PTSD prevalence rate was significantly higher than for DSM-5. Although there was overlap between those with PTSD diagnosed by ICD-11 and DSM-5, a substantial portion of people met one but not the other set of diagnostic criteria. Stein and colleagues (2014) also

found that the different diagnostic systems (DSM-IV/5. ICD-10/11) detect populations of PTSD that only have partial overlap. From 23,936 respondents from 13 countries included in the World Mental Health Survey (Kessler & Üstün, 2008), Stein and colleagues reported that only one-third of broadly defined PTSD cases met criteria in all four classification schemes, and another one-third met PTSD criteria in only one of the four systems. The authors concluded that each diagnostic system overlooks many people who are suffering from clinically significant symptoms as "all four definitions (of PTSD) are providing information on unique clinically significant cases that are omitted from the other systems" (p. 502). Differing diagnostic criteria may have implications for research as the phenotype studied may be different depending on the criteria system used.

Whichever classification system is used, most people report being exposed to traumatic events in their life time. National US estimates of exposure to DSM-IV and DSM-5 criterion A events were 89.7% and 93.7% respectively, (Kilpatrick et al., 2013), and again, exposure to multiple events was the norm. Given this high rate of exposure to trauma events and the low rates of PTSD it appears that humans are resilient, i.e. most individuals recover from traumatic experiences, and return to normal functioning. However most of this data has been collected in Western settings.

The global burden of trauma

For many areas around the globe, rates of exposure to traumatic events and PTSD prevalence are still not known at all. A thought experiment by Carriere (2004) highlighted the possible magnitude of the global burden of trauma. Carriere (2004, p. 188) referred to arguably the most accurate PTSD statistics from the USA, then suggested: "let us take its lifetime prevalence rate (say, 7%) of the general adult population. Then project this prevalence onto the world's population of 7 billion. That would yield a figure of some 500 million people with PTSD." Acknowledging the lack of sophistication in this estimate, Carriere does draw on global statistics to highlight how many people are exposed to traumatic events and circumstances worldwide either through direct, natural, structural, or cultural violence. Figures are eye opening. For example: at least 1.5 billion people currently live in countries afflicted by political or criminal violence and war (The World Bank, 2011); annually an average of 268 million people are affected by natural disasters worldwide (EM-DAT: The International Disaster Database, 2012); and worldwide, 1.22 billion people live in extreme poverty on $1.50 a day in 2010 (The World Bank, 2014). For most individuals in the world, especially those living in low income countries, the global burden of trauma is hidden, PTSD is undiagnosed, unrecognised, and in turn, untreated. Carriere (2004, p. 190) argues that "the unmet need to trauma treatment of people living with PTSD worldwide remains enormous." The need for effective trauma treatments in developing, post-war/conflict settings is discussed in chapter 4 and 5.

Theory underlying PTSD

Calls for PTSD diagnostic criteria to be moved out of the supraheading of Anxiety Disorders to a new classification of stress-related disorders (Resick, 2004) are discussed in chapter 2. The most significant change in DSM-5 was that PTSD is now within the category of "trauma- and stressor-related disorders," in which the onset of every disorder has been preceded by exposure to a traumatic or adverse environmental event (APA, 2013). The ICD-11 also proposed to move PTSD from a neurotic, stress-related and somatoform disorder to "disorders specifically associated with stress". It has been argued that the reclassification undermines the centrality of fear and avoidance in PTSD (Zoellner & Bittenger, 2011). However, this change reflects advances in knowledge about trauma and stress, with recognition that not all traumatizing events are fear-based (Schnurr, 2013), that PTSD is not an issue of simple conditioning (van der Kolk, 2000), and theoretically is not just a fear-based anxiety disorder as was explicated in DSM-III (APA, 1980) and DSM-IV (APA, 1994).

The predominant view today is that PTSD is an information processing disorder, or a disorder of memory (van der Kolk, 1996, 2000; Stickgold, 2008). The DSM-5 retained Criteria A because the work group saw the memory of the traumatic event as "at the heart of the diagnosis and the organizing core around which all other symptoms can be understood" (Friedman, 2013, p. 550). The ICD-11 working group proposed that re-experiencing trauma in the present was a core feature of PTSD, and agree with claims in the literature that PTSD is essentially a memory disorder (Brewin, 2014). A major proponent of this theory of PTSD has been Bessel van der Kolk (1994) who states that on a most basic level, PTSD develops when memories of traumatic events, that are encoded during an actual traumatic experience, fail to be processed normally after the event (van der Kolk, 1994; Levine et al., 1999). Over time - days, weeks, or months - normal memory processing reduces the intrusiveness and the affect associated with the memory. Normal memory processing leads to the integration and consolidation of trauma memories into the individual's existing network of related memories, and provides an accurate, coherent, and meaningful understanding of both the event and the implications of the individual's experience for their future. The development of PTSD occurs when normal memory processing fails, associations between the episodic memory of the trauma and other related events in semantic memory fail to develop, and the memory retains its traumatic nature over time. An unintegrated trauma memory impacts how one perceives and makes sense of following events; it remains stable over time and unaltered by other life experiences; it is easily triggered, intrusive, and vividly recalled with the emotions, thoughts, and somatic sensations experienced at the time of the event (van der Kolk, 2000).

Biology of memory processing

From a biological information processing point of view it is the nature of the traumatic memory that causes changes in the brain and body that disrupt one's ability to process the experience (van der Kolk, 1996). A neurocircuitry model of PTSD, based on neuroimaging studies of PTSD patients, emphasises the role of three brain structures; the amygdala, ventral/medial prefrontal cortex, and hippocampus (Rach, Shin, & Phelps, 2006). These structures are involved in the assessment, interpretation, and integration of incoming information with previously stored knowledge. A number of areas of the brain and associated mechanisms have been implicated in PTSD, including an exaggerated amygdala responsivity, deficient frontal cortical function, and reduced volume and deficient hippocampal function (Martin, Ressler, Binder, & Nemeroff, 2009; Rach et al., 2006; Sherin & Nemeroff, 2011; Shin, Rach, & Pitman, 2006).

These brain structures regulate and inhibit the hypothalamic-pituitary-adrenal (HPA) axis activation, which is the body's main system controlling the human stress response (Jones & Moller, 2011; Sherin & Nemroff, 2011). Normally, when faced with stress, the HPA axis is activated, cortisol levels increase, which initiates a cascade of biological responses, such as increased heart rate, increased respiration rate, and sweating (Jones & Moller, 2011). From examination of the HPA axis in PTSD it is known that the coordinatation of the neuroendocrine response system to stressors by the HPA axis becomes dysregulated, which contributes to impairment in functions such as stress reactivity and, in turn, memory (de Kloet, Vermetten, & Geuze, 2006; Jones & Moller, 2011). For PTSD sufferers abnormal stress reactivity means that even minor reminders of the trauma may precipitate a full-blown neuroendocrine stress reaction (i.e. the release of cortisol, in addition to other stress-responsive neurohormones, epinephrine and norepinephrine, vasopressin, oxytocin, and endogenous opioids) (vanderKolk, 2000; Yehuda, 1997). Core endocrine features of PTSD include abnormal regulation of cortisol and thyroid hormones (Sherin & Nemeroff, 2011), and the HPA axis negative feedback mechanism to terminate gluocorticoid release to end the stress response is compromised, which can result in prolonged, chronic arousal (Sherin & Nemeroff, 2011).[iv]

For an individual with PTSD, stimuli that are perceived as threatening, or that recall their trauma, result in a hyperresponsive and excessively activated amygdala (Cortese & Phan, 2005; Shin et al., 2006). After initial processing by the thalamus, the amygdala assesses the emotional significance of sensory information, determines whether there should be a stress response and, if so, begins the process of activating the autonomic, neurochemical and neuronatomical response to threat (LeDoux, 1992, 2000; Sotres-Bayon, Bush & LeDoux, 2004, van der Kolk, 2000; van der Kolk, Hopper & Osterman, 2001). The amagdala essentially "transforms sensory stimuli into emotional and hormonal signals, thereby initiating and controlling emotional responses" (van der Kolk, 2000, p, 17).

Incoming information arrives from the thalamus to the amygdala before any related information from the pre-frontal cortex (LeDoux, 1992). Thus, the emotional evaluation of information happens before conscious awareness of the emotional experience – so individuals are autonomically and hormonally activated prior to making a conscious appraisal of what one is reacting to (LeDoux, 1992). In addition, it is only after the amygdala decides how emotionally significant something is, that the hippocampus evaluates the information. The role of the hippocampus is to begin to organise and categorise this new information with existing information about similar experiences. The hippocampus is involved in taking information and storing it in semantic, long term form. It is also responsible for locating the experience in time, space, and place (Levine et al., 1999).

Functioning of the hippocampus can, however, be impaired by the amygdala. The strength of hippocampal activation is influenced by the intensity of input from the amygdala. The more the amgdala assesses information as significant, the stronger the hippocampus will attend to the information and retain it in memory. Very high levels of emotional arousal significantly disrupt the ability of the hippocampus to integrate the experience with pre-existing information in long term memory networks (van der Kolk, 1994). A memory of the experience is imprinted, but it is not an integrated whole memory. Rather the memory is largely isolated images, bodily sensations, smells, sounds, that feel separate from other life experiences. Because the hippocampus is unable to place the experience in time and space – the memory remains not only fragmented, but also isolated, and timeless.

Sleep research has shown that everyday, yet complex processes of cortical memory consolidation and integration occur when we are asleep, primarily during phases of REM-sleep (Dang-Vu, Desseilles, Peigneux, & Maquet, 2006; Stickgold, 1998; 2002). REM-sleep is the optimal time for the transfer of episodic memories to a cortical, long-term semantic store. The arousal in PTSD patients when thinking of trauma memories affects normal memory processing (Stickgold, 2002), in that there is a breakdown of hippacampal outflow to the cortex, proposed due to increased release of norepinephrine, producing hyperarousal and hypervigilance, disturbed sleep, overall preventing integration of memories (Stickgold, 2002).

There is still no conclusive or overarching theory that can account for the complex array of biological, psychological, and social responses to experiencing trauma. From this biological perspective, however, "the task of therapy then, becomes to associate the different elements of the trauma to each other, so that the traumatized individual can start experiencing the trauma as an integrated whole, a tragic event that happened at a particular time, on a particular occasion, instead of as a timeless emotion or bodily sensation." (Levine, Lazrove, & van der Kolk, 1999, p. 161). Just as there is no one theory of PTSD, there is no one accepted treatment.

Effective therapies for PTSD.

Two therapies are considered efficacious for the treatment of PTSD: trauma-focused cognitive behavioural therapy (CBT) and EMDR therapy (ACPMH, 2013; WHO, 2013). Several trauma-focused cognitive behavioural treatments and other therapies are considered to be evidence-based for the treatment of PTSD: narrative exposure therapy (Schauer, Neuner, & Elbert, 2011); skills training in affective and interpersonal regulation (STAIR) narrative therapy (Cloitre et al., 2002); cognitive processing therapy (Resick & Schnicke, 1992); cognitive therapy for PTSD (Ehlers & Clark, 2000); brief eclectic psychotherapy for PTSD (Gersons, Meewisse, & Nijdam, 2105); and prolonged exposure therapy (Foa, Hembree, & Rothbaum, 2007).

Effective treatments for PTSD differ from each other in a number of ways (Schnyder et al., 2015). For example, some therapies are centred around *in vivo* exposure to threat stimuli, whereas others focus on meaning making or reappraisal of traumatic experiences without exposure. The therapies also differ in techniques used to process traumatic memories (i.e. via a written narrative, verbal account, continual or intermittent thinking of the trauma experience). The length of these treatments also varies. What has been identified as the common elements of these evidence-based and efficacious therapies for PTSD are: psychoeducation; emotion regulation and coping skills; imaginal exposure; cognitive processing, restructuring, and/or meaning making; emotions; and memory processes (Schnyder et al., 2015). These common elements fit with the stage model of treatment for trauma (safety, anxiety management, and emotional processing) (van der Kolk, McFarlane, van der Hart, 1996), and are *all* part of EMDR therapy for PTSD.

EMDR therapy for the treatment of PTSD

EMDR is a standardized therapeutic approach made up of eight treatment phases that requires a comprehensive clinical evaluation, client stabilisation and preparation, and includes a three-pronged protocol to ensure processing of not only past events that underlie current pathology, but also current triggering situations, and feared future situations and challenges (Shapiro, 2001). Table 3 presents an overview of the eight-phases of EMDR therapy.

Table 3.

Overview of eight-phase eye movement desensitization and reprocessing (EMDR) therapy treatment

Phase	Purpose	Procedures
History taking	Obtain background information. Identify suitability for EMDR treatment. Identify processing targets from events in client's life according to standardized three-pronged protocol.	Standard history-taking questionnaires and diagnostic psychometrics. Review of selection criteria. Questions and techniques to identify 1) past events that have laid the groundwork for the pathology, 2) current triggers, and 3) future needs.
Preparation	Prepare appropriate clients for EMDR processing of targets.	Education regarding the symptom picture. Metaphors and techniques that foster stabilization and a sense of personal control.
Assessment	Access the target for EMDR processing by stimulating primary aspects of the memory.	Elicit the image, negative belief currently held, desired positive belief, current emotion, and physical sensation and baseline measures.
Desensitization	Process experiences toward an adaptive resolution (no distress).	Standardized protocols incorporating eye movements (taps or tones) that allow the spontaneous emergence of insights, emotions, physical sensations, and other memories.
Installation	Increase connections to positive cognitive networks.	Enhance the validity of the desired positive belief and fully integrate the positive effects within the memory network.
Body Scan	Complete processing of any residual disturbance associated with the target.	Concentration on and processing of any residual physical sensations.
Closure	Ensure client stability at the completion of an EMDR session and between sessions.	Use of guided imagery or self-control techniques if needed. Briefing regarding expectations and behavioral reports between sessions.
Reassessment	Ensure maintenance of therapeutic outcomes and stability of client.	Evaluation of treatment effects. Evaluation of integration within larger social system.

SOURCE: Reproduced with permission from Shapiro (2014).

Differing from other psychotherapies for PTSD is that within EMDR dual-attention stimuli, usually in the form of eye movements, or other bilateral stimulation (tapping or tones), are used during the processing of trauma memories. At the start of desensitisation sessions clients are asked to focus on a snap-shot image that best represents their traumatic experience, the associated negative thoughts, emotions, and body sensations. Desensitisation then involves short sets of exposure (approx. 30-60 secs) coupled with dual-attention stimulation (typically eye movements). These eye movement sets lead to significant decreases in the distress and vividness associated with target memories (Lee & Cuijpers, 2013). Throughout desensitisation clients are instructed to be mindful and simply "notice", it is explained that there's no "supposed to's", processing is different for each individual, and are directed to "just let whatever happens, happen" (Shapiro, 2001). Clients are instructed not to focus on any one memory, but to simply notice any new images, thoughts, emotions or body sensations. At the

end of each set clients are asked "what do you notice now?" Clients provide a brief description of what they are experiencing at that point in time in processing. The clinician follows standard procedures and protocols to guide their client's focus of attention throughout the desensitisation session. Therapeutic goals of EMDR are similar to other therapies: the reduction of symptoms and suffering; develop abilities to self-soothe, feel a full range of emotions; develop resilience, and the ability to cope and function adaptively both individually and socially (Shapiro, 2001).

Chapter 2 discusses the historical development of EMDR and presents a review of EMDR literature from 1989 to 2009, presented in three main phases: 1. demonstrating EMDR's effectiveness in treating PTSD; 2. demonstrating EMDR's effectiveness compared to other trauma-focused treatments for PTSD; and 3. focus on understanding the underlying mechanisms of EMDR therapy. The adaptive information processing (AIP) model (Shapiro, 2001), as the theory guiding EMDR therapy is introduced along with the dominant hypotheses regarding proposed mechanisms of action underlying EMDR. The chapter highlighted: that processes in EMDR differ from other treatments for PTSD; controversy remained about the necessity and role of the eye movement (EM) component and, if they are integral, it was not known what kind of EMs were most effective in EMDR; and although the underlying working mechanisms of EMDR remained unclear, a body of knowledge was emerging supporting orienting response, REM-hypotheses, and working memory theories of EMDR.

Chapter 3 is then an investigation of the necessity of the EMs in EMDR therapy, and the effectiveness and psychophysiological correlates of different EM tasks used during EMDR (Schubert, Lee, & Drummond, 2011). Non-clinical participants with negative autobiographical memories received a single EMDR session either without EMs, or with EMs of either varied or fixed rate of speed. The findings indicated that EMDR-with EMs led to greater reduction in distress than EMDR-without EMs. No difference in effectiveness was seen when EMs were at a fixed or varied rate. Physiologically, the EMs in EMDR were coupled with distinct psychophysiological changes that may aid memory processing. Eye movements were associated with an immediate, significant decrease in heart rate; skin conductance decreased during EM sets; heart rate variability and respiration rate increased significantly as EMs continued; and orienting responses were more frequent in the EM than no-EM condition at the start of exposure. Findings are discussed in the context of orienting response theory and REM hypotheses of EMDR. This is, to our knowledge, the first study to examine skin conductance responses during EM sets in EMDR therapy. These findings, therefore, required replication and examination in a clinical, sample of individuals with PTSD symptoms.

Chapter 4 and 5 presents confirmatory data from an examination of the effectiveness and physiological correlates of EMDR therapy to treat PTSD symptoms in a real world, clinical setting in Timor Leste (Schubert, Lee, & Drummond, 2016; Schubert et al., 2016). This research

is significant as, to our knowledge, this is the first study to examine the effectiveness of EMDR therapy for the treatment of PTSD symptoms in a post-war/conflict developing country. In Timor Leste 21 participants were treated with EMDR. PTSD, depression, and anxiety symptom changes post-EMDR treatment were compared to a stabilization control intervention period in which participants served as their own waitlist control. Chapter 4 presents treatment outcome findings, that included the overall finding that EMDR therapy was followed by significant and large reductions in PTSD symptoms (Cohen's d =2.48), depression (d = 2.09), and anxiety (d = 1.77), whereas during the control period symptoms did not improve. Chapter 5 presents physiological findings, which overall demonstrated that in EMDR desensitization sessions physiological activity decreased within the session, and eye movement sets were associated with an immediate significant decrease in heart rate and an increase in skin conductance, consistent with an orienting response. This response habituated within and across eye movement sets. These preliminary findings support the use of EMDR for treatment of adults with PTSD in a cross-cultural, post-war/conflict setting, and suggest that structured trauma treatments can be applied in Timor Leste. These findings also provide confirmatory data that effective EMDR therapy is associated with de-arousal within sessions, and that eye movement sets are associated with distinct physiological changes (orienting responses and dearousal) that may facilitate processing of traumatic memories. The need for and issues relating to conducting trauma research cross-culturally are discussed in the concluding chapter. Overall, this thesis provides evidence for the effectiveness of EMDR therapy for the treatment of PTSD, and adds to our understanding of processes involved in the resolution and recovery of trauma experiences.

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[i] In 2010 the DVA/DoD practice guideline was updated to state, "EMDR possesses efficacy for treating patients with PTSD" (p. 129), thereby contradicting the 2008 IOM report, as has every PTSD guideline since, with one exception, the IOM (2012) report. The 2012 IOM report, also commissioned by the DVA/DoD, continued to inaccurately report on scientific findings in regards to EMDR Therapy. Unfortunately, the misrepresentations of EMDR therapy in the 2008 document appeared to have been perpetuated in the IOM's (2012) initial assessment report. The EMDR International Association (EMDRIA: 2012) submitted a response to the IOM (2012) report that included a call for a corrected and revised report. The IOM (2014) final assessment report did include corrections. However, the report concluded that the "DoD and VA should use their VA/DoD Clinical Practice Guideline for Management of Post-Traumatic Stress to inform the delivery of all PTSD treatments" (p. 224). The IOM (2014) report stated that the VA/DoD guideline found that for PTSD treatment "cognitive therapy including cognitive processing therapy (CPT); exposure therapy, such as prolonged exposure (PE) therapy; and eye movement desensitization and reprocessing (EMDR) were effective psychotherapies, and SSRIs were the most effective pharmacotherapies" (p.132-131).

[ii] The proposed ICD-11 PTSD criteria are very different from DSM-5. For a discussion on the process of reviewing PTSD criteria and commentary on DSM-5 and ICD-11 comparative changes and more on potential impact this may have clinically and scientifically see the special edition of the Journal

of Traumatic Stress, 2013, volume 26, with an initial discussion (Friedman 2013a), then 3 commentaries (Brewin, 2013; Kilpatrick, 2103; Maercker & Perkonigg, 2013), and a final rebuttal (Friedman, 2013b).

[iii] Additional changes were that DSM-5 and ICD-11 acknowledge that there can be more than one traumatic event experienced. DSM-5 no longer distinguished between acute and chronic phases of PTSD, whereas ICD-11 proposed to have a separate complex PTSD diagnosis. Instead, DSM-5 added two subtypes of PTSD: a subtype with prominent dissociative symptoms for people who experience depersonalization and derealization symptoms, in addition to meeting PTSD criteria; and a separate diagnosis for PTSD in children 6 years and younger.

[iv] Trauma and stress that overwhelms the organism affects individuals over a wide range of biological structures and functioning in the body and brain. For a thorough review of the current literature that has examined the pathway to disorder in PTSD in terms of brain regions, neuronal networks, stress-related systems (e.g., the hypothalamic–pituitary–adrenal (HPA) axis), and their underlying genetic and neurogenetic bases refer to Young (2014). For a review on findings from endocrinology, neurochemistry, and brain circuitry research conducted on PTSD patients see Sherin and Nemeroff (2011). Martin and colleagues present findings from brain imaging, genetics, and psychneuroendocrinology research in relation to PTSD. For a comprehensive review of research that has examined the HPA axis in PTSD see Yehuda et al. (1997) and Jones and Moller (2011).

Chapter 2 Adult PTSD and its treatment with EMDR: A review of controversies, evidence, and theoretical knowledge.

Available at:

Attribution

SJS reviewed the literature, wrote the manuscript, conducted data analysis, interpreted findings, and reviewed the manuscript following peer review. CWL reviewed the literature, edited the manuscript, supervised and revised the manuscript. Both authors approved the final published version.

SJS 75%

Adult PTSD and its Treatment with EMDR: A Review of Controversies, Evidence, and Theoretical Knowledge

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Abstract

This article provides an overview of selective issues relating to adult posttraumatic stress disorder (PTSD) and its treatment with eye movement desensitization and reprocessing (EMDR). The article begins by providing a historical overview of PTSD, and debates about the etiology and definition of PTSD are discussed. The most predominant theories of PTSD are summarized by highlighting how they have evolved from traditional behavioral accounts based on the assumption that PTSD is an anxiety disorder to theories that now incorporate information-processing models. This article then examines the development of EMDR and the corresponding body of research that clearly demonstrates its efficacy for the treatment for adult PTSD. The underlying mechanisms of EMDR are discussed, with a focus on the importance of the eye movement component and how the therapeutic processes in EMDR differ from those of traditional exposure therapy. Finally, the adaptive information-processing (AIP) model that underlies EMDR is outlined, and evidence for the model is summarized. The article concludes by suggesting future research based on questions raised about PTSD and its treatment with EMDR when the AIP model is compared to other information-based theories of PTSD.

Keywords: EMDR; PTSD; review; theory; mechanisms of action.

"Experiencing trauma is an essential part of being human; history is written in blood" (van der Kolk & McFarlane, 1996, p. 3). As humans, however, we do have an extraordinary ability to adapt to trauma, and resilience is our most common response (Bonanno, 2005). Nonetheless, traumatic experiences can alter one's social, psychological, and biological equilibrium, and for years memories of the event can taint experiences in the present. Despite advances in our knowledge of posttraumatic stress disorder (PTSD) and the development of psychosocial treatments, almost half of those who engage in treatment for PTSD fail to fully recover (Bradley, Greene, Russ, Dutra, & Westen, 2005). Furthermore, no theory as yet provides an adequate account of all the complex phenomena and processes involved in PTSD, and our understanding of the mechanisms that underlie effective treatment, such as eye movement desensitization and reprocessing (EMDR) and exposure therapy remains unclear.

Historical Overview of PTSD

The psychological effects of trauma have been reported for centuries. The earliest evidence of exposure to a traumatic event leading to trauma reactions was recorded on a cuneiform tablet that described people's reactions to an event involving the death of King Urnamma (2111–2094 B.C.) in battle (Ben-Ezra, 2001). In the 19th century, Hermann Oppenheim (1858–1919) coined the term "traumatic neurosis," and debates began as to what constitutes the main etiological factor of trauma reactions. Neurologist Jean Martin Charcot (1825–1893) argued against Oppenheim's idea that psychic neurosis was caused by organic processes and proposed that the etiology of trauma symptoms were in fact the response of predisposed individuals to a terrifying event. Alternatively, Pierre Janet (1859–1947), who studied under Charcot, suggested that subconscious fixed ideas, or cognitive schemas established earlier in life, were responsible for neurotic trauma symptoms. Janet argued that the event itself was not the "cause of the consequent illness, but it was necessary to assign a role to the memories left by the accident" (Janet, 1924, p. 39). He believed that the encoding and retrieval of memories were central organizing factors of the mind. Joseph Breuer and Sigmund Freud (1893) also argued that the event was not the crucial etiological factor but proposed that the main casual factor was the "susceptibility of the person affected" (p. 56).

To some extent, the debate still exists today over what constitutes the core element underlying trauma reactions and whether it is the actual event, the unintegrated memories, the associated meaning, or personal vulnerability. The debate is reflected in the differing core assumptions of theories of PTSD and the focus of therapies used to treat PTSD, and it is also evident across the changing PTSD diagnostic criteria. The Diagnostic and Statistical Manual of Mental Disorders (DSM-I; 1st ed.; American Psychiatric Association, 1952) called what is now known as PTSD "stress response syndrome," and the main causal factor was stressful environmental events, such as natural disasters or war. The DSM-II (APA, 1968) referred to PTSD like symptoms as

"transient situational disturbance" (p. 48), and the etiology involved the individual, not the event, as it was believed that "if the patient has good adaptive capacity his symptoms usually recede as the stress diminishes." The DSM-III (APA, 1980) defined PTSD as a syndrome that erupted in response to a "stressor that would evoke significant symptoms of distress in almost everyone" (p. 238), thus implying that the etiological factor was no longer individual weakness but rather the event.

Defining PTSD: Controversies Over Criterion A

PTSD was and remains a unique diagnosis because the diagnostic criteria have always implied the assumption of specific etiology. In contrast to all other DSM psychiatric diagnoses (i.e., depression, schizophrenia, generalized anxiety disorder), there must be a known etiological component, an external event (criterion A: the stressor criterion) that directly relates to the trauma symptoms. However, what constitutes a traumatic stressor has changed across DSM revisions. The DSM-IV-TR (APA, 2000) currently defines the criterion A(1) stressor as when a "person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others" (p. 467). In addition, the stressor must also meet criterion A(2), which states that the stressor must be accompanied by fear, helplessness, or horror. Using such a definition, the lifetime prevalence of exposure to traumatic events may be as high as 89% (Breslau, 2001). Epidemiological research has consistently revealed that experiencing trauma is relatively common, but many people go on with their lives without becoming haunted by memories of what happened, and only a minority of trauma victims, between 5% and 10%, develop PTSD (van der Kolk & McFarlane, 1996). Such findings stimulated research in to the question of why some people develop PTSD and require treatment while others do not.

Epidemiological research and meta-analyses of PTSD risk factor research have found that more variance is accounted for by peritraumatic processes, previous trauma and psychological history, and posttrauma factors than the nature of the traumatic event itself (Brewin, Andrews, & Valentine, 2000; Ozer, Best, Lipsey, & Weiss, 2003, 2008). A growing body of literature clearly demonstrates that the PTSD syndrome can result from "small t" events that do not meet criterion A(1) (i.e., Avina & O'Donohue, 2002; Dattilio, 2004). These findings justify recent proposals to remove criterion A from the forthcoming DSM-V (Rosen, Spitzer, & McHugh, 2008) and is further justified by research that has verified that stressful life events (chronic illness, marital discord) can be as traumatic as criterion A events and generate just as many PTSD symptoms (Mol et al., 2005). In addition, Bodkin, Pope, Detke, and Hudson (2008) recently demonstrated that the prevalence of the PTSD syndrome was equivalent (78%) among patients who had experienced DSM-IV trauma and those who had not. The authors concluded that PTSD may therefore "harbour an uncertain theory of aetiology within its name" (Bodkin et

al., 2007, p. 181), and the definition may exclude people who would benefit from PTSD treatment but fail to meet current diagnostic criteria.

Evidence highlights that criterion A is not sufficient or necessary to bring about the PTSD syndrome. Therefore, it is possible that in DSM-V, criterion A be removed from the diagnostic criteria of PTSD and the stressor be treated as a risk factor rather than a causative event. However, removing criterion A from the PTSD diagnostic criteria so that it becomes like all other psychiatric diagnoses whereby presumed causative factors, such as precipitating events, are assessed as a risk factor (Rosen & Lilienfeld, 2008; Rosen et al., 2008) raises the question whether removing it keeps PTSD a unique and separate distinct clinical entity (Rosen et al., 2008). Research highlights that comorbidity is the rule rather than the exception for PTSD, and many of the symptom criteria that define PTSD also define the very disorders with which PTSD most frequently co-occurs (i.e., major depression, specific phobia, generalized anxiety disorder, and panic disorder) (Rosen et al., 2008). Several studies suggest that PTSD and depression arise from similar predictive variables and a shared vulnerability such that the disorders should not be viewed as separate distinct entities (i.e., Breslau, Davis, Peterson, & Schultz, 2000). However, other systematic research indicates that reliving experiences or flashbacks are a unique feature of PTSD. For example, Reynolds and Brewin (1998) interviewed matched patients with either PTSD or major depression and a sample of nonclinical controls about their most prominent intrusive cognition, coping strategies, and emotional responses. Their findings support the claim that flashbacks are distinctive to PTSD, as flashbacks were reported as the most frequent intrusive cognition by 43% of the PTSD group, only 9% of those with depression, and none of the nonclinical controls.

In addition to the controversy surrounding criterion A(1) for PTSD, debate also exists regarding the validity of criterion A(2), which requires emotional responses to the stressor that involve "intense fear, helplessness, or horror" (APA, 2000, p. 467). Research that has examined retrospective reports of peritraumatic fear has found that fear is generally positively correlated with the presence and severity of PTSD symptoms (i.e., Brewin, Andrews, & Rose, 2000), and since some fear is generally present with PTSD, it is often assumed that it is the predominant emotion that maintains PTSD symptoms. Most theoretical accounts of PTSD have emphasized that experiencing intensive fear is important in the development of PTSD (i.e., Foa & Kozak, 1986; Keane, Fairbank, Caddell, Zimering, & Bender, 1985). However, the evidence is mixed with regard to the role of other criterion A(2) emotions: horror and helplessness. Although some authors have found significant correlations between PTSD symptoms and peritramuatic helplessness and horror (i.e., Brewin, Andrews, & Rose, 2000), Roemer, Orsillo, Borkovec, and Litz (1998) found no significant correlation between PTSD and reports of horror, and Palmer, Kagee, Coyne, and DeMichele (2004) found no effects of either horror or helplessness. It has also been noted that PTSD can develop without experiencing any criterion A(2) emotions

during the trauma (Brewin, Andrews, & Rose, 2000) and that nonfear emotions, such as shame, anger, and guilt, are often predominant emotions experienced and involved in maintaining PTSD (Andrews, Brewin, Rose, & Kirk, 2000; Lee, Scragg, & Turner, 2001; Resick, 2004). Resick (2004) has proposed that the DSM-V PTSD criteria be expanded so that emotions beyond fear (i.e., shame, anger, and guilt) are included.

Controversies of PTSD: An Anxiety-Based or Information-Processing Disorder

Resick (2004) also proposed that for the forthcoming DSM-V PTSD be moved out of the supraheading of "Anxiety Disorders" and into a new classification of "Stress-Related Disorders" that would include the adjustment disorders, acute stress disorder, traumatic grief, and dissociative disorders. This reclassification would return PTSD, or the study of trauma reactions, back to the broad field of stress research from where it originated. The assumption currently implied by the DSM-IV that PTSD is an anxiety disorder does, however, fit with early behavioral theories of PTSD (i.e., Keane et al., 1985) that developed from conditioning and learning principles and were based on Mowrer's (1960) two-factor model of anxiety. These behavioural theories lead to the development of treatments for PTSD such as exposure, flooding, and implosion where the main aim is to alleviate fear by preventing avoidance of the feared stimuli so that habituation and extinction take place. While exposure treatments are effective in reducing fear and anxiety, there is no compelling evidence that nonfear emotions (i.e., shame, guilt, and anger) habituate to exposure alone when they are predominant (Grunert, Weis, Smucker, & Christianson, 2007). In fact, Grunert et al. (2007) demonstrated that when nonfear emotions are associated predominantly with PTSD, treatment based on habituation (i.e., prolonged exposure) fails to lead to improvement and recovery from PTSD symptoms.

Alternatively, theorists have argued that the core issue in the development and maintenance of PTSD is not anxiety or fear reactions that stem from experiencing a criterion A(1) event. Rather, it is argued that PTSD is an information-processing disorder whereby it is the way that memories of the traumatic event are processed, integrated, and represented that is the central mechanism that creates anxiety states and drives the PTSD syndrome (van der Kolk, 1994; van der Kolk & McFarlane, 1996). Theorists also propose that processing the memory of the event in a way that resolution of meaning takes place is central to the therapeutic recovery process from PTSD (Horowitz, 1976; Janoff-Bulman, 1992). Recent theories of PTSD support the idea that PTSD is an information-processing disorder. It is beyond the scope of this article to discuss all the psychological theories relating to PTSD (for an overview of PTSD theories, refer to Brewin & Holmes, 2003); however, at present, the most predominant psychological theories of PTSD are emotional processing theory (Foa & Rothbaum, 1998), Ehlers and Clark's (2000) cognitive model of PTSD, and dual-representation theory (Brewin, Dalgleish, & Joseph, 1996).

All theories can be referred to as information-processing theories of PTSD, as they initially draw on classic cognitive network models of memory and provide accounts of how trauma-related information is represented in "fear networks" (Foa & Kozak, 1986) within the cognitive system and is integrated with existing semantic memory networks. A predominant theory that has also aided in our understanding of PTSD is the adaptive information-processing (AIP) model (Shapiro, 2001). This theory is based on the assumption that PTSD is an information-processing disorder, and it is the theory on which EMDR is based.

The AIP model has guided EMDR clinical practice for the treatment of PTSD whereby the processing of traumatic memories is seen as the key element in treatment. Information-processing theories of PTSD have facilitated our understanding of EMDR and the processes involved in recovering from PTSD. Emotional processing theory (Foa & Rothbaum, 1998) aids in our understanding of EMDR, as it expands on Foa and Kozak's (1986) information-processing, "fear network" theory to account for beliefs and appraisals that exist prior to or that occur during and after trauma and how they can reinforce schemas and maintain PTSD. Ehlers and Clark's (2000) cognitive model provides what is currently considered one of the most detailed accounts of the maintenance and treatment of PTSD. They suggest that PTSD develops and persists when individuals process the trauma in a way that leads to a sense of threat. Treatment involves the elaboration of the trauma memory to increase associations and facilitate adaptive processing (i.e., processing the meaning of the event) and integrating it into one's autobiographical memory base. Dual representation theory raises questions about how EMDR may work, as, unlike other theories of PTSD, it proposes that there are two memory systems: conscious verbally accessible memories (VAMs), which are autobiographical memories that can be deliberately retrieved, and unconscious situationally accessible memories (SAMs), which are triggered by reminders of the trauma. PTSD results when VAM representations of the trauma event fail to form, and only SAMs of the trauma are experienced as intrusive images that are triggered by cues and are accompanied by emotional and/or physiological arousal experienced during the traumatic event. Treatment involves the construction or transfer of detailed consciously accessible memories (VAM) that previously existed only in an unintegrated form in the SAM system. All three psychological theories of PTSD propose that PTSD develops when memories of the traumatic event are poorly elaborated, are often difficult to verbalize, and are unintegrated with preexisting memory networks.

In summary, over the past 30 years, theories of PTSD have evolved from traditional behavioral accounts of PTSD that were based on conditioning and learning principles and models of anxiety to current theories of PTSD that have incorporated information processing models. These information-processing theories of PTSD emphasize the idea that unprocessed trauma memories leads to the development and maintenance of PTSD (Brewin & Holmes, 2003). Current theories also provide more comprehensive explanations of a wide range of complex

processes involved in the development, maintenance, and recovery from PTSD. For example, they account for a range of emotions associated with PTSD beyond fear and consider cognitive elements, such as incorporating the meaning of the event into preexisting schema networks. Currently, meta-analyses that have examined the efficacy of treatments for PTSD indicate that trauma-focused exposure therapies, based on the idea that PTSD is an anxiety disorder, are effective (Bisson et al., 2007; van Etten & Taylor, 1998). However, as traditional theories of PTSD and exposure treatments have developed, simultaneously EMDR has evolved, and meta-analyses reveal it to be equally effective as exposure-based therapies for the treatment of PTSD. Although EMDR treatment of PTSD is based on the assumption that PTSD is an information-processing disorder, EMDR has evolved from AIP theory (Shapiro, 2001), which is an information-processing theory that is separate yet comparative with those incorporated into current theories of PTSD. The remainder of this article examines the development of EMDR and corresponding research. The AIP model is then discussed and evidence for the model summarized. The article concludes by highlighting questions raised about PTSD and its treatment when the AIP model is compared to other information based theories of PTSD.

EMDR Treatment of Adult PTSD: History of Research and Current Status

EMD was initially developed by Shapiro (1989) to resolve trauma symptoms by desensitizing traumatic memories. EMD evolved to become EMDR (Shapiro, 1991, 1995, 2001), which is an integrative, comprehensive treatment approach that contains many elements ofeffective psychodynamic, cognitive-behavioral, experiential, interpersonal, and physiological therapies. Marquis and Marquis (in press) present a historical account of EMDR, but what is interesting to note is that the challenges EMDR has faced since its conception have, in many ways, been similar to those that arose with the inception of PTSD. EMDR received divergent reactions from scientists and professionals; it challenged existing ideas about how trauma was being treated, it was not initially accepted, and it was criticized because of the impression that it was being proposed as a one-session cure for PTSD rather than a structured eight-phase treatment approach that aims to access and process past, present, and future aspects of dysfunctionally stored memories that form the basis of current pathology. EMDR created a vocal group of concerned skeptics who influenced the progression of the field as it drove proponents to produce exceptional amounts of evidence to justify claims. Just as PTSD has been the most researched anxiety disorder in the past 20 years (Boschen, 2008), EMDR is one of its most extensively researched treatments.

First and Second Phases of Research

The history of research into EMDR for the treatment of adult PTSD can be divided into three main phases: (a) demonstrating EMDR's effectiveness in treating PTSD, (b) demonstrating EMDR's effectiveness against other trauma-focused treatments for PTSD, and (c) focusing on understanding the underlying mechanisms of EMDR. In the early phase of EMDR research (1989–1998), strong evidence arose demonstrating that EMDR was consistently superior to waitlist or delayed treatment controls. As seen in Table 1, average effect sizes 1 for EMDR and control conditions pre- to posttreatment are 1.19 and 0.07, respectively. Effect size is a measure of the change in mean scores between conditions after controlling for the variance in each condition. The effect size of 0.07 for control conditions is below what is considered a small effect, which is generally between 0.2 and 0.3. Around 0.5 is referred to as a medium effect, and the effect size of 1.19 for EMDR is considered a large effect, which is generally anything above 0.8.

Table 1.

RCTs of EMDR versus Wait-list Control for the Treatment of Adult PTSD

						Effect Size	
Study	Conditions	Population Type	N	No. of Sessions	% Dropout	Pretreatment to Posttreatment	Pretreatment to Follow-Up
Boudewyns and Hyer (1996)	EMDR Standard care	Combat veterans with PTSD	21 22	5–7[a] 8 group	[b]	0.67 0.38	— —
Devilly et al. (1998)	EMDR Psychiatric support	Combat veterans with PTSD	13 6	2 —	32 63	0.37 −0.01	0.11 0.12
Hogeberg et al. (2007)	EMDR WL control	Occupation-based PTSD	12 9	5 —	8 18	0.93 0.35	— —
Jensen (1994)	EMDR WL control	Combat veterans with PTSD	13 12	3 in 10 days —	— —	−0.50 −1.01	— —
Rothbaum (1997)	EMDR WL control	Female rape victims with PTSD	10 8	3 3	9 20	2.43 0.51	3.19 —
Wilson et al. (1995, 1997)	EMDR WL control	Trauma memory, 46% with PTSD	37 37	3 —	8 8	1.61 —	1.63 —

Note. Effect sizes pre- to posttreatment and pretreatment to follow-up were calculated for the PTSD measures used in each study using Cohen's *d* statistic and were based on completer rather than end-point or intent-to-treat analyses. *N* = number of participants who com- pleted therapy at posttreatment.

[a]This condition also received eight sessions of the standard group treatment program offered. [b]Four participants chose not to complete the study; however, which condition they were in was not specified.

Table 2.

RCTs of EMDR versus Other Nonspecific Treatments used to Treat Adult PTSD

Study	Conditions	Population Type	N	No. of Sessions	% Dropout	Effect Size Pretreatment to Posttreatment	Effect Size Pretreatment to Follow-Up
Carlson et al. (1998)	EMDR	Combat veterans with PTSD	10	12	0	1.44	2.31
	Relaxation		13	12	7	0.60	0.75
	Routine care /WL		12	6	0	0.63	—
Edmond and Rubin (2004);	EMDR	Trauma memory of sexual abuse	20	6	0	1.52	2.41
	Routine care		20	6	0	1.60	0.60
Edmond (1999)	WL control		19		0	0.50	0.31
Marcus (1997); Marcus et al. (2004)	EMDR	Civilians with PTSD	33	Unlimited	0	2.03	2.69
	Standard care		33	Unlimited	3	0.57	1.16
Scheck et al. (1998)	EMDR	Trauma memory, 77% with PTSD	60	22	30	1.45	N/A
	Active listening					1.02	

In the second phase of EMDR research, beginning a decade after Shapiro's (1989) seminal publication, four randomized controlled trials examined the effectiveness of EMDR compared to nonspecific therapies for PTSD, and again EMDR was consistently more effective in treating adult PTSD than other nonspecific treatments. As shown in Table 2, average effect sizes for EMDR compared to nonspecific treatments are 1.61 and 0.88, respectively. In this phase of research, nine randomized controlled trials also compared the effectiveness of EMDR to other trauma-focused therapies, such as cognitive-behavioral therapy (Devilly & Spence, 1999), exposure (Ironson, Freund, Strauss, & Williams, 2002; Rogers et al., 1999; Rothbaum, Astin, & Marsteller, 2005; Taylor et al., 2003), and exposure with cognitive restructuring (Power et al., 2002) or stress inoculation (Lee, Gavriel, Drummond, Richards, & Greenwald, 2002). Average effect sizes for EMDR and other trauma-focused treatments are similar with the change from pre- to posttreatment being 1.74 and 1.52, respectively (see Table 3). With the exception of Devilly and Spence (1999) and Taylor et al. (2003), EMDR has been found to be roughly equal in its effectiveness with exposure-based therapies. However, others have found a slight trend toward greater efficiency for EMDR over exposure therapy (Ironson et al., 2002; Lee et al., 2002; Power et al., 2002). Compared to exposure therapy, EMDR was found to result in a more rapid reduction of symptoms (Ironson et al., 2002; Rogers et al., 1999), was reported to require fewer treatment sessions (van Etten & Taylor, 1998), and resulted in fewer dropouts (Ironson et al., 2002; Rothbaum et al., 2005; Taylor et al., 2003). The first meta-analysis to examine the comparative effectiveness of EMDR to exposure-based therapies found that randomized controlled trials did not reveal any significant difference in effect (van Etten & Taylor, 1998),

yet the authors did note that EMDR required fewer sessions. Subsequent meta-analyses over the past 10 years have also found equivalent effect sizes for EMDR and exposure therapy for adult PTSD (Bisson et al., 2007; Bradley et al., 2005; Davidson & Parker, 2001). However, Rothbaum et al. (2005) has noted that EMDR achieved its results without the use of the 30 to 60 hours of homework often used in exposure therapies. As yet, only one randomized controlled trial (Ironson et al., 2002) has compared the effectiveness of EMDR and exposure therapy and controlled for treatment time and the amount of homework between sessions. Although homework is not part of the EMDR protocol, all participants were required to do in vivo exposure homework. The authors found that EMDR led to a more rapid reduction in symptoms, as 7 out of 10 EMDR participants had a 70% reduction in PTSD symptoms after 3 sessions, compared to only 2 out of 12 in the prolonged exposure group. However, further studies comparing EMDR to exposure therapy that control for treatment time and homework are required.

EMDR Research: Variability in Methodological Strengths and Limitations in Knowledge

Although effect sizes are equivalent between traditional exposure-based treatments and EMDR for the treatment of PTSD, it is worth noting that there are varying degrees of methodological strengths between the nine randomized controlled trails that have examined their comparative effectiveness (see Table 3). For example Devilly, Spence, and Rapee (1998) did not meet basic requirements for randomization, the majority of participants were treated by the same therapist, and the trained assessor was not blind or independent. Lee et al. (2002) also used a nonblind assessor who was not independent, and Taylor et al. (2003) failed to discuss intent to treat analysis. This being especially significant because of the high dropout rate in the traditional exposure condition (32%) compared to the EMDR condition (21%). However, a number of randomized controlled trials that have examined the effectiveness of EMDR have very few or no major limitations, for example, Carlson, Chemtob, Rusnak, Hedlund, and Muraoka (1998), Rothbaum et al. (2005), and van der Kolk et al. (2007), all of whom found statistically significant improvement in treatment groups with large effect sizes for EMDR. The average effect size for these three studies are 1.89 (pre- to posttreatment), and 2.10 (pretreatment to follow-up). Maxfield and Hyer (2002) have examined the relationship between effect size and methodology. Interestingly, they found that a significant relationship exists between effect size and treatment fidelity, and the more rigorous the methodology, the greater the effect size for EMDR.

Table 3.

RCTs of EMDR versus trauma-focused therapies for the treatment of adult PTSD

Study	Conditions	Population Type	N	No. of Sessions	% Dropout	Effect Size Pretreatment to Posttreatment	Pretreatment to Follow-Up
Devilly and Spence (1999)	EMDR	Mixed PTSD civilians	11	Up to 8	35	1.56	0.32
	CBT variant (TTP)		12	8	20	2.36	1.26
Ironson et al. (2002)	EMDR	Civilians with PTSD	10	1–3	0	1.53	1.43
	PE		9	1–3	25	2.18	3.03
Lee et al. (2002)	EMDR	Civilians with PTSD	12	7	8	1.87	2.17
	SIT + PE		12	7	8	1.45	1.46
	WL control		29	—	0	0.5	—
Power et al. (2002)	EMDR	Mixed PTSD civilians	27	10	31	2.76	—
	Exposure + CR		21	10	43	1.84	—
	Wait list		24	—	17		—
Rogers et al. (1999)	EMDR	Combat veterans with PTSD	6	1	0	0.85	—
	Exposure		6	1	0	0.2	—
							—
Rothbaum et al. (2005)	EMDR	Rape victims with PTSD	20	9	13	1.91	1.46
	PE		20	9	20	2.02	2.30
	WL control		20		17	0.38	—
Taylor et al. (2003)	EMDR	Mixed PTSD civilians	15	8	21	N/A	1.96
	Exposure therapy		15	8	32		2.42
	Relaxation training		15	8	21		1.89
Vaughan et al. (1994)	EMDR	Mixed PTSD civilians, 78% with PTSD	12	3–5	0	1.35	1.34
	Imaginal Exposure		13	3–5	0	0.65	0.72
			11	3–5	0	0.57	1.00
	Muscle Relaxation					0.23	—
	WL control						
van der Kolk et al. (2007)	EMDR	Mixed PTSD civilians	24	8	17	2.32	2.54
	Fluoxetine		26	8	13	1.95	1.93
	Pill placebo		26	8	10	1.84	—

It is also important to note that although EMDR has demonstrated its efficacy for the treatment of adult PTSD, the majority of randomized controlled trials to date have utilized civilian, single-trauma patient groups, and complex trauma cases are often excluded. A number of studies have, however, focused on combat (i.e., Carlson et al., 1998) and sexual abuse (i.e., Rothbaum et al., 2005) trauma that has led to PTSD. Although more studies are needed to establish the effectiveness of EMDR with these populations, what appears to be evident is that that approximately three sessions of EMDR are necessary for comprehensive treatment of single-trauma PTSD (i.e., Ironson et al., 2002; Marcus, 1997; Marcus, Marquis, & Sakai, 2004; Rothbaum, 1997; Wilson, Becker, & Tinker, 1995, 1997); however, complex, multiple trauma populations require many more sessions for the treatment to be complete and robust (i.e., Carlson et al., 1998; Marcus, 1997; Marcus et al., 2004). Further research is needed to

systematically examine the effect that the number and type of traumatic memories the individual has on treatment outcome.

Further research is also required to examine the effect the variable of time since the traumatic event has on the effectiveness of EMDR for treating PTSD. Recently, van der Kolk et al. (2007) conducted a randomized control trial that included both adult PTSD participants with child abuse trauma and adult-onset trauma. What was found was that eight sessions of EMDR was insufficient for those with childhood abuse as their response was less robust than those with adult-onset trauma. Although at 6-month follow-up 89% of the child-onset trauma group lost their PTSD diagnosis, only 33% were asymptomatic, compared to 75% of those with adult-onset trauma. Similarly, in a study by Edmond, Rubin, and Wambach (1999) where adult survivors of childhood sexual abuse showed significant reductions in trauma symptoms after six sessions of EMDR, the authors concluded that although this number of sessions helped alleviate symptoms, longer-term treatment was likely to be needed to adequately address all the issues confronting participants. Research is needed to better determine if lengthier EMDR is a requirement for childhood trauma survivors and whether these patients would also benefit from an extended preparation phase or a combination of treatments (i.e., EMDR combined with pharmacotherapy). Only one randomized trial to date has examined the efficacy of EMDR compared to pharmacological treatment for PTSD (van der Kolk et al., 2007). EMDR was found to be more successful than pharmacotherapy in achieving sustained reductions in PTSD symptoms, but this was primarily for adult-onset trauma survivors. It may be possible that childhood trauma responds to a combination of EMDR and pharmacotherapy, which is common in clinical practice, but the efficacy of this is yet to be examined.

The efficacy of EMDR in the treatment of disorders other than PTSD is less established. Clinicians often use EMDR to treat a variety of presenting problems, such as those that stem from criterion A events that frequently do not meet criterion A for PTSD, such as extramarital affairs (Dattilio, 2004), sexual harassment (Avina & O'Donohue, 2002), and complicated grief (Sprang, 2001). A recent randomized control trial by Cvetek (2008) demonstrated that EMDR is effective for treating participants who experience distress as a result of "small t" incidents that fail to meet criterion A for PTSD. Significant reductions in trauma symptoms were found for EMDR over an active listening control. Cvetek's fi nding supports those of Wilson et al. (1995, 1997), who found that EMDR was equally effective in decreasing symptoms associated with trauma memories for those who met PTSD diagnostic criteria and those who did not and were instead referred to as "partial PTSD participants." Keeping in mind the potential removal of criterion A in DSM-V and the knowledge that the PTSD syndrome can develop without exposure to a criterion A event, the expansion of research into the effectiveness of EMDR for treating "small t" traumas is encouraged.

Given the research described previously, it is not surprising that several independent bodies have rated EMDR in the highest category of effectiveness for the treatment of PTSD. For example, in the International Society of Stress Studies practice guidelines (Foa, Keane, Friedman, & Cohen, 2009), EMDR has recently been ranked as an evidence-based level A treatment for PTSD in adults. EMDR is rated in the highest category of research and support in the clinical practice guidelines of the American Psychiatric Association (2004) and the US Department of Veterans Affairs and Department of Defense (2004). EMDR is also acknowledged as an evidence-based treatment for PTSD by the U.K. National Institute for Clinical Excellence (2005) and the Australian Centre for Posttraumatic Mental Health (2007). In addition, a growing number of international guidelines (i.e., Bleich, Kotler, Kutz, & Shalev, 2002; CREST, 2003; INSERM, 2004) also recommend EMDR for the treatment of adult PTSD.

Third Phase of Research

The third and current phase of research into EMDR is now heavily focused on understanding the underlying mechanisms of effective treatment. At present, as discussed in the next section, what is known is that the eye movements in EMDR do contribute to the therapeutic process, that the processes involved are not the same as those in traditional exposure, and, to date, that the most promising theoretical account of EMDR is the AIP model (Shapiro, 2001).

The Role of Eye Movements in EMDR

Although the clinical efficacy of EMDR has been demonstrated, the role of the eye movements (EMs) in EMDR continues to be controversial, with critics arguing that they are superfluous to the method (i.e., Nevid, Rathus, & Greene, 2008). Although findings regarding the role of EMs are inconsistent, it is important to note that much of the research in this area is filled with methodological problems, such as analogue studies with small, nonclinical samples and insufficient use of EMs. To date, no randomized controlled trial has been conducted to compare EMDR with EMs to EMDR without EMs on a large sample of adults with PTSD. Thus, ruling out the need for EMs in EMDR is premature. Furthermore, Perkins and Rouanzoin (2002) highlight that:

> EMDR has received empirical validation as a treatment for PTSD, and the tested procedure includes the eye movement (or alternative dual-attention) component. Therefore, the removal of these stimuli from the validated procedure requires prior component analyses adequate to rule them out as a signifcant treatment element. In the absence of such studies, their removal is without empirical justification. (p. 86)

Although the exact role of the EMs in EMDR remains unknown, numerous laboratory studies have examined the effects of EMs on memory and cognitive processes for participants not experiencing PTSD. Research suggests that EMs may contribute to the effectiveness of EMDR

through a number of different processes, as they have been found to decrease the vividness and/or emotionality of autobiographical memories (Andrade, Kavanagh, & Baddeley, 1997; Barrowcliff, Gray, Freeman, & MacCulloch, 2004; Kavanagh, Freese, Andrade, & May, 2001; Maxfield, Melnyk, & Hayman, 2008; Sharpley, Montgomery, & Scalzo, 1996; van den Hout, Muris, Salemink, & Kindt, 2001), enhance the retrieval of episodic memories (Christman, Garvey, Propper, & Phaneuf, 2003), and increase cognitive flexibility (Kuiken, Bears, Miall, & Smith, 2001–2002) and may change interhemispheric coherence in frontal areas of the brain (Propper, Pierce, Geisler, Christman, & Bellorado, 2007). Research has also demonstrated that EMs produce psychophysiological dearousal when accessing distressing memories (i.e., Barrowcliff et al., 2004). Additional treatment studies that have demonstrated a dearousal effect measured physiological changes during EMDR and indicate that the EMs are associated with physiological responses that are characteristic of an orienting response (Sack, Lempa, Steinmetz, Lamprecht, & Hofmann, 2008) but may also resemble physiological characteristics of REM sleep (Elofsson, von Sche'ele, Theorell, & Söndergaard, 2008). At present, more research is required to examine the precise causal role of the EMs in EMDR. For example, do EMs enhance the processing of memories, leading to physiological dearousal, or do the physiological effects of the EMs facilitate the processing of memories? For a more thorough review of the role of EMs in EMDR, see Propper and Christman (2008) and Gunter and Bodner (this issue).

The Effects of EMDR Are Different to Exposure

Although some reviewers have suggested that the main effect in EMDR is that akin to traditional exposure (i.e., Benish, Imel, & Wampold, 2008), there are three major differences between the therapeutic processes that distinguish EMDR from traditional exposure. According to a strict exposure definition, these differences should result in EMDR being ineffective for treating PTSD as the procedures should sensitize rather than desensitize its recipients (Perkins & Rouanzoin, 2002). First, EMDR is not based on habituation, as it uses short 20- to 50-second, interrupted exposures rather than continuous 20- to 100-minute exposures, traditionally recommended for prolonged exposure (Rogers & Silver, 2002). Second, EMDR is nondirective, allowing for free association. The client often moves quickly through scenes or skips scenes by spontaneously changing to other memories that arise. In EMDR, this is not seen as avoidance but is instead viewed as effective memory processing (Lee & Drummond, 2008; Lee, Taylor, & Drummond, 2006). Third, in EMDR, reliving the traumatic memory in the present tense is not a requirement of therapy. Taking a third-party perspective on the trauma is also not seen as avoidance, and, unlike traditional exposure, reliving is not associated with improvement in EMDR (Lee & Drummond, 2008). According to the assumptions of emotional processing theory (Foa & Rothbaum, 1998), which underlie exposure therapy for PTSD, the type of exposure that occurs in EMDR should result in minimal decreased fear if exposure is the

proposed mechanism of change. Yet EMDR is effective in treating adult PTSD and associated symptoms.

Theories Regarding the Underlying Mechanisms of EMDR

Common factors across psychotherapies contribute to their individual efficacy. However, it does not follow that all improvement is due mainly to those factors. EMDR involves many therapeutic elements. Therefore, a number of agents of change may be involved beyond the effects of exposure and the EMs. Yet, like any therapy, the exact mechanisms of change underlying EMDR are currently unknown, but a number of theories exist. EMDR is currently guided by the AIP model, which is consistent with Foa and Kozak's (1986) information-processing theory. There are, however, four other main hypotheses regarding the theoretical mechanisms of EMDR that have, in the current third wave of research, begun to accumulate a sound empirical base and offer support for the AIP model: orienting response activation, REM-like mechanisms, the theory of increased hemispheric communication, and working memory accounts.

AIP Model

The AIP model offers an explanation for the basis and recovery of trauma symptoms, it guides clinical case conceptualization, and directs treatment. The AIP model, which is consistent with other learning-based theories of PTSD, proposes that new experiences are processed by assimilating them with existing memory networks and that adaptive learning takes place (Shapiro, 1995, 2001). Shapiro (2001) states that adaptive learning occurs when information from new experiences are perceived and "the connections to appropriate associations are made and that the experience is used constructively by the individual and is integrated into a positive emotional and cognitive schema" (p. 30). According to the AIP model, pathology arises when memories of an experience are not adequately processed. Rather, the memory is dysfunctionally stored in its own neural network, which, like a fear network (Foa & Kozak, 1986), contains thoughts, images, emotions, and sensations associated with the event that, when triggered, influence perceptions, attitudes, and behavior in the present. Whether the memories are of an event that meets criterion A(1) for PTSD or are memories of "small t" traumas or whether the predominant emotions are criterion A(2) emotions or other emotions such as shame or guilt is irrelevant to the model. The main etiological factor of trauma symptoms is that the memories are unintegrated and dysfunctionally stored.

The AIP model suggests that it is the activation of the information-processing system that leads to the resolution of dysfunctionally stored traumatic memories. However, Shapiro (2001) proposes that information processing is facilitated primarily by three mechanisms in EMDR: (a)

deconditioning that proceeds through a relaxation response, (b) neurological changes in the brain that activate and strengthen weak associations, and (c) factors that are involved with the client's dual focus of attention on both the memory and a concurrent task, such as EMs. Evidence for these proposed mechanisms of action have come out of various research paradigms that have examined how EMDR may work.

Research Examining the AIP Model

Research into the activation of an orienting response (MacCulloch & Feldman, 1996) in EMDR provides support that a relaxation response occurs when the EMs begin that may facilitate treatment by reducing stress to a tolerable level so that processing of memories can occur (Barrowcliff et al., 2004; Elofsson et al., 2008; Sack et al., 2008). Research that has investigated physiological responses created by the EMs in EMDR has also noted that changes characteristic of a REMlike state occur (Elofsson et al., 2008). Stickgold (2002) has proposed a REM hypothesis of EMDR that states that the EMs in EMDR, through repeated orienting responses, may "push-start" memory processing in the brain by inducing a physiological and neurological state that is akin to REM sleep that aids in the transfer and integration of memories. Overall, the EMs in EMDR have an effect on physiology by creating either an orienting response or a REM-like state, but further research is required to clarify the effect and refine related theories.

Research into the theory of increased hemispheric communication provides empirical support for Shapiro's (2001) second hypothesized mechanism that information processing in the treatment of traumatic memories is facilitated by neurological changes in the brain that activate and strengthen weak associations. The theory of increased hemispheric communication proposed that horizontal EMs increase communication between both hemispheres of the brain, thus enhancing one's ability to remember the traumatic event while not becoming aroused (Christman et al., 2003). However, at present, mixed fi ndings characterize the evidence for the increased hemispheric communication account of how EMDR works. For example, recent research by Propper et al. (2007) reported that engaging in bilateral EMs decreased rather than increased interhemispheric coherence. Also contrary to the account, Gunter and Bodner (2008) demonstrated that vertical EMs, which in theory do not increase hemispheric communication, were equally effective as horizontal EMs at reducing ratings vividness, emotionality, and completeness of unpleasant autobiographical memories.

Research has also begun to accumulate to support Shapiro's (2001) third hypothesis, that the client's dual focus of attention on both the trauma memory and a concurrent task is a mechanism that facilitates information processing in EMDR. What is gaining empirical support are working memory models that can account for the discrepant findings within research that have examined the increased hemispheric communication account. For example, Gunter and

Bodner (2008) explained the equivalent benefits for vertical and horizontal EMs by proposing that their finding supported a working memory account, as both tasks taxed the visual spatial sketch pad component of working memory to a similar degree. A working memory account of EMDR proposes that the dual-attention stimuli in EMDR, whether it be EMs or some other task such as tapping or tones, leads clients to attend to both the external stimulus and internally to the trauma-related memories (Maxfield et al., 2008). Baddeley's (1986) model of working memory suggests that each component of working memory has limited memory resource capacity, so when two tasks make demands on the attentional capacity of a component, performance on the primary task deteriorates. That is, in EMDR, when individuals engage in EMs while simultaneously focusing on a memory image, the quality of the image deteriorates, presumably because it gets pushed out of working memory and integrated into long-term memory, where the memory then becomes less vivid and less emotional. Space does not permit an extended discussion on the research that has examined working memory effects; for this and for more in-depth discussions of the orienting response, REM-like mechanisms, and the increased hemispheric communication account of EMDR, refer to Gunter and Bodner (this issue).

Consistent with other information-processing theories of PTSD, AIP theory assumes the existence of an information-processing system that, when working appropriately, incorporates new experiences into pre-existing memory networks, which are the basis of perception, attitudes, and behavior. At the heart of AIP and other information-processing models of PTSD, such as emotional processing theory (Foa & Rothbaum, 1998) and dual-representation theory (Brewin et al., 1996), is that recovery of PTSD is all about the elaboration or processing of memory. The AIP model is consistent with emotional processing theory, as it is assumed that the fear memory of the traumatic event needs to be activated and that corrective information must be provided that is incompatible with the fear structure. Associations are made with existing memory networks, resulting in learning, relief of emotional distress, and material becoming available for future use. All information-processing models assume that dysfunctional trauma reactions result when information relating to a traumatic event is not adequately processed. There are, however, some distinct differences between AIP and current information-based theories of PTSD, and these differences have important implications for theory and treatment of PTSD.

AIP Contrasted With Other Psychological Models of PTSD

Unlike AIP, dual-representation theory (Brewin et al., 1996) assumes that the concept of a single memory system is inadequate to account for the full range of complex phenomena associated with PTSD. Thus, as previously mentioned, two memory systems are proposed to exist: conscious VAMs and unconscious SAMs, which are unintegrated and triggered by

reminders of the trauma and, when triggered, are accompanied by emotional and/or physiological arousal experienced during the trauma. Although dual-representation theory is not linked to any specific treatment protocol, like AIP is linked to EMDR, it is proposed that treatment needs to focus on two pathological processes. One involves resolving conscious negative beliefs and associated emotions, and the other involves managing intrusive, unintegrated memories in the SAM system (Brewin & Holmes, 2003). It is hypothesized that following effective exposure and/or cognitive therapy, the old SAMs remain intact but are no longer triggered and experienced because newly created VAMs become more distinctive and rehearsed and thus have a retrieval advantage when the memory is triggered. In contrast to the assumptions in AIP, it is also proposed that because the old SAMs remain unchanged and are not integrated in memory in any way, they retain their potential to be retrieved by the right combination of triggers (Brewin & Holmes, 2003). Also in contrast to AIP, where it is assumed that processing new information in the therapeutic process aids in the assimilation of the trauma memory into existing memory networks, it is assumed in dual-representation theory that the new information creates new memories that compete with the old trauma memories. This suggests an extinction mechanism over assimilation or reconsolidation of trauma memories.

The precise mechanism by which memories are processed in the treatment of PTSD remains to be empirically clarified. The AIP model proposes that the mechanism of action in EMDR is "the assimilation of adaptive information found in other memory networks linking into the network holding the previously isolated disturbing event" (Solomon & Shapiro, 2008, p. 316). Thus, EMDR transmutes the dysfunctionally stored memory by integrating it with preexisting memory networks. Other psychological theories propose that treatment of memories in PTSD is based on extinction, whereby the process is believed to be that new memories are created that compete for and attain retrieval advantage over old trauma memories (Suzuki et al., 2004). Thus, original trauma memories are able to be retrieved in their original form if triggered by the right combination of cues in the future (Brewin & Holmes, 2003). Solomon and Shapiro (2008) suggest that research comparing recall of original memories and rates and kinds of retrieval patterns can shed light on whether the primary mechanism of action is based on extinction or on association, assimilation, and reconsolidation. They also suggest that EMDR, because of the process of assimilation, may aid in lowered relapse rates when clients experience a similar trauma in the future. Future research needs to compare extinction and reconsolidation models. Solomon and Shapiro suggest that this could be done by following individuals treated with EMDR and exposure-based treatments to investigate if there is a difference in participants' reactions to similar traumas posttreatment.

Future research could also investigate other differences between AIP and emotional processing models of PTSD. For example, the AIP model assumes that trauma symptoms resolve as a result of processing salient or associated memories related to the traumatic event. Alternatively,

emotional processing theory (Foa & Rothbaum, 1998) assumes that it is necessary to focus on and relive the traumatic event, to maintain a level of arousal until habituation occurs. Research supporting the AIP model demonstrates that information processing through association leads to changes such as reductions in vividness and emotionality and in appraisals related to the memory. Targeting associated memories in non-EMDR treatment studies has also been found to reduce the vividness, distress, and negative beliefs associated with target memories (Wild, Hackman, & Clark, 2008). EMDR may therefore be particularly well suited for individuals who are either avoidant of therapy for fear of having to relive the trauma or cannot tolerate repeated imaginal reliving of the traumatic event. Future research could focus on clarifying if it is possible to reduce trauma symptoms by targeting memories associated to the trauma memory rather than the specific memory of the event.

Summary and Conclusion

Although trauma reactions have been reported for centuries, controversy remains over how to define PTSD, and the validity of the diagnostic criteria continues to be challenged. Despite this and the theoretical advances that have occurred as our knowledge about PTSD has improved, procedures for the two most effective treatments for PTSD have changed minimally across time. Exposure procedures have changed very little over the years, and the EMDR protocol has remained unchanged since 1991 (Shapiro, 1991). Since Shapiro's (1989) seminal publication that demonstrated the effectiveness of EMDR, what is now known after 20 years of research is that EMDR is an efficacious treatment for adult PTSD. What is also known is that the EMs in EMDR appear to produce various effects that facilitate memory processing and that the processes involved in EMDR are different from those of traditional exposure. However, although evidence is accumulating in support of the AIP model on which EMDR is based, there is still no empirically supported model that is capable of explaining the precise underlying mechanism of EMDR. One must be reminded, though, that even after years of research, we are still struggling to determine the mechanisms through which many psychotherapeutic treatments operate and create change. In addition, the specific mechanisms through which PTSD develops and resolves are not entirely understood, and, as yet, no theory adequately accounts for and explains all the phenomena involved in PTSD. The success of EMDR has challenged existing contemporary theories of PTSD and has advanced our understanding of the therapeutic processes in PTSD. In turn, current theories of PTSD may facilitate our understanding of how EMDR works to resolve PTSD. Comparing and contrasting EMDR and non-EMDR theories of PTSD has more potential to advance our knowledge of effective treatments.

Note

1. Effect sizes pretreatment to posttreatment and pretreatment to follow-up were calculated for the PTSD measures used in each study using Cohen's d statistic. Cohen's d is calculated by determining the difference in mean scores for each condition divided by the pooled variance (i.e., SDpooled = $\sqrt{[(SD\ 2\ pre + SD\ 2\ post)/2]}$).

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Update of research post publication

Since publication of this review, clinical interest, scholarly recognition, and acceptance of EMDR therapy appears to have grown steadily within Australia and around the world. In 2013 The Australian Centre for Posttraumatic Mental Health (2013) endorsed EMDR therapy as evidence-based for PTSD. The same year, the World Health Organization (2013) guidelines for the management of conditions specifically related to stress recommended that trauma-focused CBT and EMDR are the only psychotherapies recommended for children, adolescents and adults with PTSD. Whereas the Australian guidelines (2013) highlighted similarities of EMDR to trauma-focused CBT, with eye movements being a unique feature of EMDR, the WHO (2013) guidelines highlighted significant differences between the two treatments.

> "Like CBT with a trauma focus, EMDR therapy aims to reduce subjective distress and strengthen adaptive cognitions related to the traumatic event. Unlike CBT with a trauma focus, EMDR does not involve (a) detailed descriptions of the event, (b) direct challenging of beliefs, (c) extended exposure, or (d) homework" (WHO, 2013, p.1).

Over the past decade many PTSD practice guidelines have been published internationally. A review of international PTSD treatment guidelines in 2010 acknowledged the high level of consensus between guidelines, but also offered reasons for differences in recommendations for treatment (Forbes et al., 2010). The review stated that one area of debate across guidelines has been the conclusions drawn from the body of EMDR literature. Forbes et al. (2010) mentioned the disparate IOM (2008) findings, which were discussed in chapter 1 (also see Lee & Schubert, 2009, Appendix A), then highlighted that in all but the APA (2004) guideline, EMDR has been given the highest rating, along with trauma-focused CBT, for evidence-based PTSD treatment in adults. The APA guideline gave EMDR a second, as opposed to a first level rating. Forbes et al. stated that this inconsistency was due to the APA guideline taking into account the perceived absence of support for the necessity of the eye movements used in EMDR. All other practice guidelines were guided by the treatment data effect sizes alone when rating the intervention. The recent Australian PTSD guidelines (ACPMH, 2013) addressed this very point in a comment on the effect of eye movements in EMDR. It was stated that questions of treatment efficacy are separate from questions of treatment component effectiveness and underlying mechanisms of treatment. Therefore, since the review did not address the literature on underlying mechanisms for any therapy, a discussion of the eye movement component was removed.

In 2013 a meta-analysis was published that appears to have marked an end to the necessity of the EMs in EMDR being such a contentious issue. This meta-analysis (Lee & Cuijpers, 2013) examined studies that compared EMDR treatment with and without EMs, and laboratory studies with non-clinical populations that compared the effects of EMs versus no EMs on negative autobiographical memories. Effect sizes were significant for both groups, with EMs having an

effect over no EMs in facilitating the processing of memories. Effect sizes were large for the laboratory studies (Cohen's $\delta = 0.74$), moderate in clinical studies (Cohen's $\delta = 0.41$), and results were dependent upon the quality of the study, i.e. studies that followed treatment manuals, and studies in which therapists were fully trained in EMDR therapy, had larger effects for EMs. This meta-analysis received critical commentary (Devilly et al., 2014), but with rebuttal from Lee and Cujipers (2014). In 2012 Jefferies and Davies reviewed EMDR literature and, like Lee and Cuijpers (2013), concluded that eye movements are an essential component of EMDR, and that a theoretical rationale exists for their inclusion in treatment. This review suggested that further research into the contribution of EMs and investigations into their theoretical basis is needed (Jefferies & Davies, 2012). A recent example of such work is a time-course investigation of changes in vividness and emotionality of unpleasant autobiographical memories associated with EMs (Smeets et al., 2012). Smeets et al. (2012) found that EMs led to reductions in vividness of emotional memories, and this preceded the reductions in distress. Further research is required to see if this same order occurs in EMDR in a clinical population

Two meta-analyses have been published since the article presented in the previous chapter was published. Watts and colleagues (2012) examined randomized controlled trials for PTSD to determine the efficacy of all treatments (psychotherapy and medication). Conclusions for psychotherapy treatments were that cognitive therapy, exposure therapy, and EMDR therapy were effective, with differing designs and participant characteristics of studies making it difficult to identify a single most effective or preferred treatment for PTSD. In 2015 a meta-analysis indicated that EMDR was slightly superior to CBT for treating adult PTSD (Chen, Zang, Hu, & Liang, 2015). Analysis of subscale PTSD symptom scores suggested that compared to CBT, EMDR may be more effective for decreasing the severity of intrusion and arousal symptoms. This is the first meta-analysis to make this overall conclusion, and as authors suggest, caution is required when interpreting these findings due to the limited number (11) and poor quality of studies included. Another recent meta-analysis (Ho & Lee, 2012), that aimed to examine if trauma-focused CBT and EMDR differed in efficacy for PTSD treatment, also claimed EMDR to be a more efficient. This conclusion was made on the basis that although the same level of symptom improvement is attained by both therapies, EMDR required minimal homework (hours on average = 2.65, $SD = 4.02$) compared to trauma-focused CBT (hours on average = 23, $SD = 10.58$). This meta-analysis also found a significant advantage for EMDR over trauma-focused CBT in reducing depression symptoms.

The requirement of little-to-no between session tasks in EMDR therapy is important clinically. No homework tasks allows therapy to be conducted on consecutive days, and is attractive for some populations and settings where between session tasks are difficult (i.e. post disaster, refugee camps), and particularly for those clients with markedly chaotic daily lives, more severe symptoms, comorbid, and complex trauma presentations. In chapter 2 the review highlighted

that EMDR is efficacious in the treatment of simpler cases of PTSD, but the effectiveness of treatments for more complex cases has been less widely studied. Korn (2009) examined the literature on the treatment of complex PTSD and chronically traumatized populations, with a focus on EMDR treatment and research. This review presented a phase-oriented EMDR treatment approach for working with complex PTSD. Acknowledging the lack of randomised controlled studies of any treatment for complex PTSD, this review highlighted some clinical strengths of EMDR when treating complex trauma (i.e. short bursts of exposure, that the patient is in control during desensitisation, the ability to process material without giving a detailed recount, and at times processing of trauma material can be done without words at all). A Chochrane review was also conducted that investigated a wide range of psychological therapies for chronic PTSD (Bisson et al., 2013). The review included 16 EMDR RCTs that treated complex PTSD cases (Carlson 1998; Devilly 1998; Devilly 1999; Hogberg 2007; Ironson 2002; Jensen 1994; Lee 2002; Marcus 1997; Power 2002; Rothbaum 1997; Rothbaum 2005; Scheck 1998; Taylor 2003; Vaughan 1994; Nijdam 2012). Immediately posttreatment there was no statistically significant difference between individual trauma-focused CBT, EMDR and non-trauma-focused CBT. There was evidence that individual trauma-focused CBT and EMDR were superior to non-TFCBT at between 1 and 4 months following treatment. Overall, the review rated that research in this area was very low quality, with small samples, underpowered, and follow-up data regarding the effects of any psychological treatment was limited.

To date 30 RCTs have evaluated EMDR therapy as a treatment for trauma. In chapter 2 it was highlighted that the effectiveness of EMDR for disorders other than PTSD was less established. Post 2009 however, there have been developments in evidence for effective use of EMDR to treat: psychotic disorder (van den Berg et al., 2015), PTSD and psychosis (De Bont et al., 2013), and trauma in psychosis (van den Berg & van der Gaag, 2012); addictions (Abel & O'Brien, 2014), depression (Hase et al., 2015; Hoffman et al., 2016), obsessive-compulsive disorder (Marr, 2012), panic disorder (Leeds, 2012), grief (Solomon & Rando, 2012), bipolar patients with trauma histories (Amann et al., 2116; Novo et al., 2014); and numerous medical conditions (Shapiro, 2014), such as migraines (Konuk et al., 2011), cancer (Capezzani et al., 2013) and chronic pain (de Roos et al., 2010; Mazzola et al., 2009; Tesarz et al., 2014).

Following publication of chapter 2 came an awareness of the dearth of evidence for the effectiveness of EMDR therapy, or any effective therapy for PTSD for that matter, in many settings, contexts, and cultures, i.e. post-disaster, post-war/conflict, and in low-income, developing, non-Western, cross-cultural populations. Cross-culturally there was evidence that EMDR could be effectively adapted to treat disaster-related PTSD and acute stress in adults (Errebo et al., 2008; Konuk et al., 2006). Cross-cultural EMDR research has stemmed predominantly from the establishment of EMDR Humanitarian Assistance Programs (EMDR HAP) in the late 1990's which has led training of EMDR therapy for the treatment of trauma to

take place throughout the world following natural disasters, war and terror zones, areas of deprivation and human disasters (i.e. Errebo et al., 2008; Farrell et al 2011; Gelbach, 2014). Large scale, real world project evaluations, including examination of treatment data, suggest that EMDR is applicable, effective, and efficient in post-disaster settings (Konuk et al., 2006). However, conducting systematic, controlled, scientific research in the chaos of disaster and war is challenging ethically, logistically, practically, politically, and financially.

An issue of the Journal of EMDR Practice and Research (volume 8, number 4, 2014) that commemorated 25 years of EMDR treatment research provided an overview of EMDR humanitarian projects around the globe (i.e. in areas such as Africa, the Middle East, and Asia, to name a few, and in contexts following natural and man-made disasters, wars, terrorism, poverty, and violence). A systematic review in 2014 examined the evidence for treating natural disaster related PTSD with EMDR therapy (Natha & Daiches, 2014). From eight studies (4 RCTs, 1 part-controlled, and 3 uncontrolled studies), the authors concluded that EMDR was effective and efficient in reducing psychological distress in survivors of natural disasters. Half of the studies, however, included targeted child survivors. In addition to reductions seen in trauma symptoms, statistical and clinical significant reductions were seen in symptoms of anxiety, depression, fear, grief, and phobia. Half of the studies in this review also demonstrated clinical significance after just one session, indicating the possibility of EMDR as a resource-, time-, and cost-effective intervention post-natural disaster. While there is still no consensus on the use of EMDR, or any treatment post large scale disaster (Gelbach & Davis, 2007), EMDR therapy looks promising in regards to acceptability, feasibility, and effectiveness in various contexts and cultures. Despite difficulties in conducting trauma focused research in many populations and contexts, research continues to accumulate steadily.

At this point in time there remains no published research on the cultural appropriateness and effectiveness of EMDR therapy in indigenous populations within Australia. Also, despite the growing body of research on EMDR's effectiveness in various settings, cultures, and contexts, to our knowledge there has been no investigation of underlying mechanisms of EMDR, or treatment component research outside of Western treatment settings in developed countries. It would be a mistake to assume that EMDR works the same way, or that elements of the protocol are equally effective in all populations, presentations, contexts, and settings worldwide. In a collaborative paper by Schnyder (2015, p. 8) and the pioneer developers of seven empirically supported psychotherapies for trauma-related disorders, it was concluded that in addition to future work developing treatments that are tailored to the needs of specific patient groups, that:

> A better understanding of underlying mechanisms of action is clearly needed. Such systematic research can help identify the most effective treatment elements, so that therapies can become more powerful and more streamlined. In addition, studying mechanisms can also help identify processes or mechanisms that have been overlooked and that may significantly affect outcome.

Summary and link to next chapter

The review in chapter 2 highlighted that: EMDR is efficacious for treatment of PTSD; the processes in EMDR differ from other PTSD treatments; controversy remained about the necessity and role of the eye movement (EM) component; and although the underlying mechanisms of EMDR remained unclear, evidence was emerging supporting orienting response, REM-sleep, and working memory theories of EMDR.

Chapter 3 presents a study that examined the effectiveness of EMDR therapy, but with a primary aim of investigating the necessity of EMs in EMDR, and the psychophysiological correlates of EM tasks used during therapy. The study also examined the effects of two different types of EMs used in EMDR, cued at a fixed or varied rate. Sixty-two non-clinical participants with negative autobiographical memories received a single EMDR session either without EMs, or with EMs cued at a fixed or varied rate. Psychophysiological measures were recorded throughout each session, and EM sets were marked in physiological files to allow for examination of the physiological correlates of the eye movements in EMDR therapy, compared to EMDR-without eye movements. Heart rate, heart rate variability, respiration rate, and skin conductance were recorded, as they could be measured noninvasively without interfering with therapy. These measures are also commonly used as indices for de-arousal and are assumed to be involved in the physiological pathways operating in working models of EMDR, specifically orienting response and REM-sleep models of EMDR therapy. To our knowledge, with the exception of Wilson and colleagues (1996) twenty years ago, this is the only other study to have examined the psychophysiological correlates of a full EMDR desensitisation session, with versus EMs. More recent examinations of autonomic changes during EMDR therapy in naturalistic treatment sessions have now been reported (Elofsson et al., 2008; Sack, Lempa, Steinmetz, Lamprecht, & Hofmann, 2008), but these two investigations did not have a comparison or control group with which to compare observed physiological changes throughout therapy.

Chapter 3   The efficacy and psycho-physiological correlates of dual-attention tasks in eye movement desensitization and reprocessing (EMDR).

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Attribution

SJS, CWL, and PD planned and designed the research. SJS collected all data, conducted data analysis, interpreted findings, reviewed the literature, wrote the manuscript, and reviewed the manuscript following peer review. CWL and PD supervised and both edited and critically reviewed the manuscript, and approved the final published version.

SJS 75%

The efficacy and psychophysiological correlates of dual-attention tasks in eye movement desensitization and reprocessing (EMDR)

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Abstract

This study aimed to investigate the psychophysiological correlates and the effectiveness of different dual-attention tasks used during eye movement desensitization and reprocessing (EMDR). Sixty-two nonclinical participants with negative autobiographical memories received a single session of EMDR without eye movements, or EMDR that included eye movements of either varied or fixed rate of speed. Subjective units of distress and vividness of the memory were recorded at pre-treatment, post-treatment, and 1week follow-up. EMDR-with eye movements led to greater reduction in distress than EMDR-without eye movements. Heart rate decreased significantly when eye movements began; skin conductance decreased during eye movement sets; heart rate variability and respiration rate increased significantly as eye movements continued; and orienting responses were more frequent in the eye movement than no-eye movement condition at the start of exposure. Findings indicate that the eye movement component in EMDR is beneficial, and is coupled with distinct psychophysiological changes that may aid in processing negative memories.

Keywords: EMDR; Eye movements; Autobiographical memory; Psychophysiology; Orienting response.

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1. Introduction

An extensive body of literature has demonstrated efficacy of eye movement desensitization and reprocessing (EMDR) for the treatment of posttraumatic stress disorder (PTSD). Meta-analyses that have examined efficacy of EMDR have concluded that it is as effective as traditional exposure therapy (Bisson et al., 2007; Bradley,Greene, Russ, Dutra, & Westen, 2005), and many international clinical practice guidelines recommend both therapies for the treatment of PTSD (Foa, Keane, Friedman, & Cohen, 2009; National Institute for Clinical Excellence, 2005). However, processes that operate in EMDR remain unclear. In particular, a longstanding debate continues in the literature about whether processes in EMDR are different from those of traditional exposure, and controversy still remains about the role of the eye movements in EMDR.

EMDR is a complex therapy with many elements (Solomon & Shapiro, 2008). Processes identified in EMDR include mindfulness, somatic awareness, free association, cognitive restructuring, and conditioning. These processes may interact to create the positive effects achieved through EMDR (Gunter & Bodner, 2009; Solomon & Shapiro, 2008). However, the mechanism of change in EMDR that has received most attention in the scientific literature is the eye movements (EMs) and other bilateral stimulation (i.e., tones and tapping) that are used as a dual-attention task within the procedure. To date, research that has examined the effect of the Ems in EMDR has resulted in mixed and inconsistent findings. It has been demonstrated that a single session of EMDR-with EMs leads to greater reductions in distress compared to EMDR-without Ems (Lee&Drummond, 2008; Wilson, Silver, Covi,&Foster, 1996). However, other researchers have reported that EMDR-with or -without EMs led to significant positive, but equivalent treatment effects (Pitman et al., 1996; Renfrey & Spates, 1994). Davidson and Parker (2001) employed meta-analysis to examine the impact of the Ems in EMDR, but found only marginally significant effects of the EMs in clinical populations. Thus, at present the contribution that EMs make to overall clinical effectiveness remains unclear.

A separate, expansive body of literature demonstrates that EMs have various effects on cognitive, neurological, and physiological processes that aid in memory processing. Laboratory research on non-clinical samples has demonstrated that when negative memories are recalled induced EMs decrease the emotionality and degree of vividness associated with them (Andrade, Kavanagh, & Baddeley, 1997; Barrowcliff, Gray, Freeman, & MacCulloch, 2004; Gunter & Bodner, 2008; Kavanagh, Freese, Andrade, & May, 2001; Maxfield, Melnyk, & Hayman, 2008; van den Hout, Muris, Salemink, & Kindt, 2001). Induced saccadic EMs have also been shown to affect cognitive processes such that they enhance episodic memory retrieval (Christman, Garvey, Propper, & Phaneuf, 2003; Christman, Propper, & Dion, 2004; Propper & Christman, 2008), increase the accuracy of memories recalled (Christman et al., 2004; Lyle, Logan, &

Roediger, 2008; Parker, Relph, & Dagnall, 2008), induce cognitive and semantic flexibility, and facilitate attentional orienting (Kuiken et al., 2001–2002). Research investigating the neurological effects of EMs has demonstrated that saccadic EMs create changes in brain activation that enhance memory processing (Christman et al., 2003; Christman et al., 2004; Christman, Propper, & Brown, 2006).

While neurological changes created by EMs is a relatively new field of research, the physiological effects of induced EMs have been reported for many years, not only in laboratory studies but also more recently in treatment studies with PTSD patients (Elofsson, von Schèele, Theorell, & Söndergaard, 2008; Sack et al., 2008). EMs produce distinct psychophysiological effects, with most studies suggesting that they are associated with psychophysiological dearousal (for a review, see Söndergaard & Elofsson, 2008). For example, Barrowcliff et al. (2004) found that when participants brought-to-mind negative autobiographical memories EMs, compared to an eyes stationary condition, consistently reduced physiological arousal as indicated by significantly lower skin conductance. They concluded that their findings offer support for the orienting response theory of EMDR (MacCulloch and Feldman, 1996).

The orienting response (OR) was first described by Pavlov (1927) as "a "what-is-it" reflex which brings about the immediate response in man and animals to the slightest change in the world around them, so that they immediately orientate their appropriate receptor organ in accordance with the perceptible quality in the agent bringing about the change, making full investigation of it" (p. 12). Russian physiologist Eugene Sokolov (1963) proposed that the OR has two distinct phases: first, an alerting reaction in response to a novel stimulus in the environment; and second, habituation that leads to a reduction of the OR with repeated stimulus presentations in the face of no danger or threat. The OR is a well defined reflex and it is one of the most heavily investigated topics in psychophysiology (Sokolov & Cacioppo, 1997). The psychophysiological profile of the OR is characterized by an increase in parasympathetic tone (reflected by bradycardia and increased heart rate variability), decreases in respiration rate, and an increase in sympathetic tone (reflected by skin conductance increases and skin temperature reductions) (Öhman, Hamm, & Hugdahl, 2000). This reaction is a short-term (less than 10 s) response that habituates quickly. Shapiro (1995) has proposed that desensitization of trauma memories occurs in EMDR through possible mechanisms such as the orienting response, and other mechanisms such as disruptions in working memory and reciprocal inhibition.

 The EM component in EMDR is thought to aid in the processing of memories by taxing working memory (Maxfield et al., 2008). Working memory theories of EMDR are based on Baddeley and Hitch's (1974) model that states that working memory is a capacity limited system that is responsible for consciously maintaining information in the face of ongoing information processing and/or distraction. Working memory theory proposes that targeted

memories are held in working memory during EMDR. Concurrently engaging in EMs during EMDR overloads working memory capacity and, in turn, the memories held in mind become less vivid. Working memory theory predicts that the more complex the dual-attention task in EMDR, the greater the reductions in vividness and distress associated with negative memories.

A third account of EMDR proposes that counter-conditioning through reciprocal inhibition (Wolpe, 1991) is a mechanism underlying EMDR. The theory of reciprocal inhibition posits that two incongruent responses (relaxation and anxiety) cannot coexist. Research suggests that the EMs in EMDR, through inducing ORs that dissipate, create a state of physiological dearousal while patients simultaneously think about the traumatic memory (Wilson et al., 1996). Thus, a relaxation response is paired with the distress associated with the traumatic memory and, in turn, the association between the traumatic memory and the distress response weakens. Studies using EMDR have found that psychophysiological dearousal occurs from before to after successful treatment (Aubert-Khalfa, Roques, & Blin, 2008; Forbeset al., 1994; Sack, Lempa, & Lamprecht, 2007). Surprisingly, however, very little empirical research has examined psychophysiological changes during treatment sessions in patients with PTSD.

The first published study to have examined the mechanisms of EMDR by investigating the autonomic responses during EMDR was by Wilson et al. (1996). Eighteen subjects with distressing memories of traumatic events were treated with a single session of either EMDR-with EMs or two comparison treatments (EMDR-with tapping, or EMDR-with no EMs). EMDR-with EMs, but neither of the comparison conditions, led to significant physiological dearousal from before to after treatment. Onset of the EMs was associated with a relaxation response, suggesting that reciprocal inhibition is at least one of the mechanisms underlying EMDR.

More recently similar autonomic changes have been reported during EMDR intervention in naturalistic treatment settings with PTSD clients (Elofsson et al., 2008; Sack, Lempa, Steinmetz, Lamprecht, & Hofmann, 2008). Both studies provide support for a dearousal model of EMDR, as the authors demonstrated that EMDR resulted in significant physiological dearousal across the treatment session, reflected by a shift in autonomic balance as indicated by lowered heart rate (HR), respiration rate (RR), skin conductance (SC), and increased heart rate variability (HRV). Analysis of the within session physiological processes also indicated that the EM component in EMDR was associated with certain physiological changes. When the EMs began HR significantly decreased within the first 10 s, and HRV increased, together indicating decreased sympathetic and increased parasympathetic activity respectively. Although RR decreased across sessions, both Sack and Elofsson found that EM sets were associated with a significant increase in RR. Elofsson and colleagues also demonstrated that EMs were associated with a trend towards a decrease in SC. Sack and colleagues concluded that there was a clear

association between the onset of redirecting the focus of awareness and following the therapist's moving hand with one's eyes and the elicitation an orienting response with psychophysiological de-arousal. A limitation of these findings was that neither study included a control group; therefore, the causal relationship between the onset of the EMs and the observed psychophysiological changes remains unclear.

The primary aim of this study was to investigate the psychophysiological correlates of the EM component in EMDR during a single treatment session by comparing findings to an EMDR condition with the eye movements omitted from the procedure. The study therefore also assessed the necessity of the EMs in EMDR. A further aim was to examine the effectiveness and psychophysiological correlates of two different types of eye movements commonly used in EMDR: fixed rate versus varied rate.

It was hypothesized that EM conditions would be more effective than the no-EM condition at reducing distress associated with negative memories. A further hypothesis was that the varied EM condition, assumed to be more taxing on working memory, would be more effective than the fixed EM condition and would generate more orienting responses. It was also hypothesized that physiological arousal would decrease within treatment sessions, and that different physiological responses would be noted for the EM conditions compared to the no-EM condition. Finally, it was expected that the physiological patterns of an orienting response would occur at the beginning of stimulation sets for the EM conditions.

2. Method and materials

2.1. Participants

Sixty-four psychology students from an Australian university were recruited, and two were excluded. An inclusion criterion was that the participants had a memory of a stressful experience that still created a level of distress. One participant was excluded due to scoring above 30 on the Dissociative Experiences Scale (DES-II: Carlson & Putnam, 1993) and the other participant's rate of distress at pre-test was too low to warrant treatment. The 51 females (82.3%) and 11 males (17.7%) who completed treatment had an average age of 24.74 years (SD = 9.671, range = 18–58 years). Eighty five percent of the participants were Caucasian and 15% were Asian. The majority (86%) of participants received course credit for participating. After receiving information about the aims of the study, all participants gave their written consent. The University Human Research Ethics committee approved the study.

2.2. Design

This experiment had one between participants independent variable with three levels: 1. fixed eye movements (EM-fixed), 2. varied eye movements (EM-varied), and 3. a no eye movement control (no-EM). In all conditions participants received EMDR treatment that differed only in the type of dual-attention task used during stimulation sets. Participants in the EM-fixed condition engaged in eye movements that were fixed in width and were a constant rate of one back and forth per second. Participants in the EM-varied condition received eye movements that varied in speed and width. The induced EMs were thus pursuit EMs that involved catch-up and/or anticipatory saccadic intrusions (Collewijn & Tamminga, 1984; Kapoula, Yang, Bonnet, Bourtoire, & Sandretto, 2010), however the extent of saccadic intrusions were not measured. In the no-EM, exposure only control, the eye movements were removed from the EMDR procedure. Instead, during each set participants closed their eyes for the average period of a set (approximately 24 s).

2.3. Procedure and measures

Before any discussion of trauma memories participants completed the Dissociative Experiences Scale (DES: Bernstein & Putnam, 1986). This is a commonly used, standardized test of dissociation for non-clinical and clinical samples. In college samples high scorers have been identified as those scoring above 30 (Zingrone & Alvarado, 2001); thus to avoid including participants with dissociative tendencies those who scored above 30 were excluded.

Participants were asked to recall a stressful or traumatic experience that had happened to them in the past that still created distress when they thought of the experience in the present. Participants were introduced to the Subjective Units of Distress Scale (SUDs: Wolpe, 1991), which is an 11-point self-report scale (0 = no disturbance or distress; 10 = the highest distress possible) routinely used to assess the intensity of distress associated with a specific experience. The validity of the SUDs scale has been demonstrated (Kaplan, Smith,&Coons, 1995; Kim, Bae,&Park, 2008), and the scale has been shown to correlate with several physiological measures of stress (Thyer, Papsdorf, Davis, & Vallecorsa, 1984).

Participants were asked to recall an incident that was associated with a score of approximately 6 on the SUDs scale. Participants described the incident and identified the most distressing moment. This moment became the target memory. Participants were asked to rate the vividness of the target memory by holding it in mind for 10 s and indicating on a 10 cm visual analogue scale the degree to which the image appeared vivid from "not at all clear" (extreme left) to "very clear" (extreme right). This measure has been used in previous studies to rate vividness (Lee & Drummond, 2008; van den Hout et al., 2001). Following this, participants completed an

Impact of Events Scale (IES: Horowitz, Wilmer, & Alvarez, 1979) for the incident. Treatment was then administered.

Treatment in all conditions followed Shapiro's (2001) EMDR protocol and included six phases: 1. Preparation, 2. Target assessment, 3. Desensitization, 4. Installation of a positive cognition, 5. Body scan, and 6. Closure. After the preparation phase the therapist allocated participants to a condition by drawing the top unmarked instruction package from a shuffled pile. Treatment rationales were given as per the instructions for the particular assigned condition. After this, participants completed an expectancy scale that was designed to assess the degree to which they expected their assigned condition to be successful at reducing the distress associated with their target memory. The 10-point expectancy scale was based on expectancy items used in previous research (Borkovec&Nau, 1972; Feske & Goldstein, 1997; Lee & Drummond, 2008).

Once desensitization began treatment continued for a maximum of 45 min. This controlled for the amount of treatment participants received, but meant that the session length did not always allow for the installation phase and body scan to be completed. If SUDs did not decrease significantly, a relaxation or safe place procedure was administered after all physiological measures had been recorded, but before closing the session. Participants were followed up 1 week later via telephone to attain a SUDs and vividness (VAS) rating relating to the target memory.

Treatment was administered by the first author, a post-graduate clinical psychology student with level II EMDR training (accredited by the international EMDR association). After treatment participants rated their response to the question "how confident do you believe the therapist was that the type of procedure used to process the emotional memory would help you?" on an 11-point scale (0 = not confident, 10 = extremely confident). Treatment sessions were videotaped. The second author randomly selected 6 tapes from the EM conditions and 6 from the no-EM condition and rated the sessions according to a fidelity checklist provided from EMDR training. The checklist used a 7-point scale to rate the implementation of the EMDR treatment procedures (1 = poor, 4 = fair, and 7 = excellent). For ratings of treatment fidelity, a mean overall integrity rating of 6.27 ($SD = 0.14$) was assigned to the therapy sessions in the EM conditions, and 6.18 ($SD = 0.15$) to the sessions in the no-EM condition. These means were not significantly different, $t10 = 1.02$, $p = .33$.

2.4. Psychophysiological assessment

Physiological variables measured were HR, HRV, RR, and SC. These variables were chosen because they could be measured noninvasively, without interference to treatment, and because they are commonly used as indices for de-arousal and are assumed to be involved in the physiological pathways operating in working models of EMDR. Prior to participants providing

a description of their distressing experience, electrodes and sensors were placed and the physiological variables were allowed to stabilize for a 5 min adaptation period. Data acquisition took place throughout the whole session.

Electrocardiogram (ECG) data was recorded using a standard three-lead configuration where Ag-AgCl-electrodes were placed on the inner aspect of both forearms and the right ankle. SC was measured using a Galvanic Skin Response Amplifier GSR100C (Biopac Systems Inc.), andwasrecorded bymeansof constant voltage (0.5 V, set to a Gain of 2S per volt) using a pair of Ag/AgCl-electrodes (8mm internal diameter) filled with electrode gel (Johnson and Johnson KY Jelly as recommended by Edelberg, 1967). Electrodes were attached to the second phalanx of the middle and ring fingers on participant's non-dominant hand. RR was acquired using a flexible respiration belt that detected changes in thoracic circumference. Signals were sampled 1000 times/second via a Biopac MP100 data acquisition system and data was stored and averaged using Acknowledge software 3.9.0 (Biopac Systems Inc.).

2.5. Psychophysiological signals processing

Physiological measures were monitored during the recording and visually inspected offline. Recording artifacts were manually identified and corrected by interpolation if less than 10% of any measurement period needed correction; otherwise, measurement periods were discarded (resulting in differing degrees of freedom throughout the analysis).

To calculate HR and HRV a time series waveform of interbeat intervals was generated from the ECG data. From this the average heart beat per minute was calculated for each measurement period. Due to the nature of the EMDR protocol, with relatively short stimulation sets, and the short measurement periods examined in this study, HRV was calculated using the square root of the mean squared differences (RMSSD) between successive interbeat intervals. RMSSD is the most commonly used method for calculating HRV from interval differences between heartbeats (Thayer, Hansen, & Johnson, 2008). It has been documented that HRV from short recordings can assess cardiac autonomic activity (Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996). There is growing evidence that RMSSD is a suitable means to assess parasympathetic nervous system activity, with reduced activity (i.e. low RMSSD values) indicating a stress response. In addition, research by Schroeder et al. (2004) demonstrated that RMSSD calculated from 10 s of data showed the same reproducibility as those obtained from 6min; thus the HRV parameters in this data set should be accurate in assessing cardiac autonomic activity.

As the interval generated from raw respiratory data was markedly influenced by artifact, RR was determined by manually counting and averaging the number of breaths over each measurement period, and was expressed in breaths per minute. SC was measured and expressed

in µS, and was determined by averaging responses over each measurement period. The number of skin conductance responses (SCRs) was also examined. A significant SCR was defined as a trough-to-peak increase of at least 0.04µS. Thus, any response greater than this was tallied and averaged for each measurement period. SCRs were expressed in responses per minute when comparing the number in the first three stimulation sets compared to the last three sets. SCRs within sets were expressed as the number occurring per 10 s. The amplitude of SCRs was also recorded, averaged for each measurement period, and analysed.

2.6. Data reduction and statistical analyses

Self-report within session trends across conditions were investigated using a repeated measures ANOVA to examine the effect of time. Specific hypotheses about the changes in self-reported measures for each condition were examined using contrast analysis by conducting oneway ANOVAs that compared changes in the EM fixed condition to the EM-varied condition, and also changes in the EM conditions combined to the no-EM condition.

To assess psychophysiological changes within sessions the following measurement periods were defined: first, a 30 s baseline period immediately prior to commencing the desensitization phase and another immediately after EMDR treatment ended; second, the mean of the physiological variables was calculated within the first 3 and last 3 sets of the session. To assess the physiological changes during EM or no-EM/exposure periods the following measurement periods were defined: A: 10 s interval prior to stimulation (pre-stimulation); B: first 10 s of ongoing stimulation; C: middle period of stimulation. This period was defined as the difference between the first and final 10 s of each set. D: final 10 s of stimulation. Data were not included if any measurement period was less than 10 s.

Significant effects were examined using a repeated measures ANOVA, with the treatment condition as a between participants factor and time as the repeated factor. Post hoc analyses used paired samples t-tests for within condition comparisons and independent t-tests for between condition comparisons. Bonferroni corrections were used with all t-tests, and an overall significance level was set at an alpha level of .05. To report the magnitude of statistically significant effects partial eta squared (n^2_p) is used to report effect sizes for repeated measures ANOVAs and Cohen's d for oneway ANOVAs and t-tests. Data were analyzed using SPSS 17.

3. Results

3.1. Preliminary analysis

Prior to the main analysis, appropriate tests were conducted to determine whether groups were equivalent in terms of stimulation periods received during treatment, baseline data associated

with the target memory, and expectancies of treatment. Within EMDR sessions the mean number of stimulation periods (with SD in parentheses) for all treatment conditions were: EM-fixed = 24.43 (7.58), EM-varied = 25.95 (7.41), no-EM = 27.95 (9.14). A oneway ANOVA revealed that these means were not significantly different, $F_{2, 59} = .98$, $p = .38$. Oneway ANOVAs were also used to investigate differences between treatment groups on pre-treatment measures. No differences were found for the IES, $F2, 59 = .53$, $p = .59$, DES-II, $F_{2, 59} = .50$, $p = .61$, SUDs, $F_{2, 59} = .62$, $p = .54$, or VAS ratings, $F_{2, 59} = .09$, $p = .92$. The associated scores on the IES ($M = 30.92$, SD = 11.62) and the pre-treatment SUDs ratings ($M = 6.92$, SD = 1.24) indicated that the majority of participants chose memories associated with a medium level of trauma symptomatology and a moderate degree of distress. No differences were found between treatment conditions on treatment expectancy ratings, $F_{2, 59} = .09$, $p = .41$, or the participant's perception of the therapist's confidence in the treatment process, $F_{2, 24} = .10$, $p = .91$. Thus, random assignment appears to have resulted in each condition being equivalent prior to the intervention, and there is no evidence that expectancy or therapist confidence in the treatment conditions played a part in treatment effects.

3.2. Self-report within session trends

A repeated measures ANOVA revealed that SUDs decreased significantly in all treatment conditions over time, F2, 118 = 256.21, p < .0005, n2p = .81 (see Fig. 1). The rate of improvement across treatment conditions was investigated with oneway ANOVAs to compare the EM conditions combined to the no-EM condition, and also to compare the EM-Fixed to the EM-varied condition. When comparing the EM to the no-EM condition the analysis revealed that participants in the EM condition had significantly lower SUDs ratings than those in the no-EM condition at both post-treatment, F1, 60 = 3.72, p = .03, d = .46 (one-tailed), and at follow-up, F1, 60 = 5.59, p = .01, d = .61, (one-tailed). In contrast to what was hypothesized, no significant differences were found in reported SUDs ratings of participants in the EM-fixed condition compared to the EM-varied condition at either post-treatment or follow-up, F1, 40 = 2.06, p = .16, d = .45 and F1, 40 = 2.44, p = .13, d = .49 respectively.

A repeated measures ANOVA revealed that VAS ratings decreased significantly in all treatment conditions over time, F2, 118 = 68.49, p < .0005, n2p = .54 (see Fig. 2).

The reduction in VAS ratings across treatment conditions was investigated with oneway ANOVAs using planned contrasts. Although there was a trend towards the reductions in VAS ratings being greater in the EM conditions compared to the no-EM condition at post-treatment no significant differences were found between the EM and no-EM conditions, or between the EM-fixed and EM-varied condition at any time point.
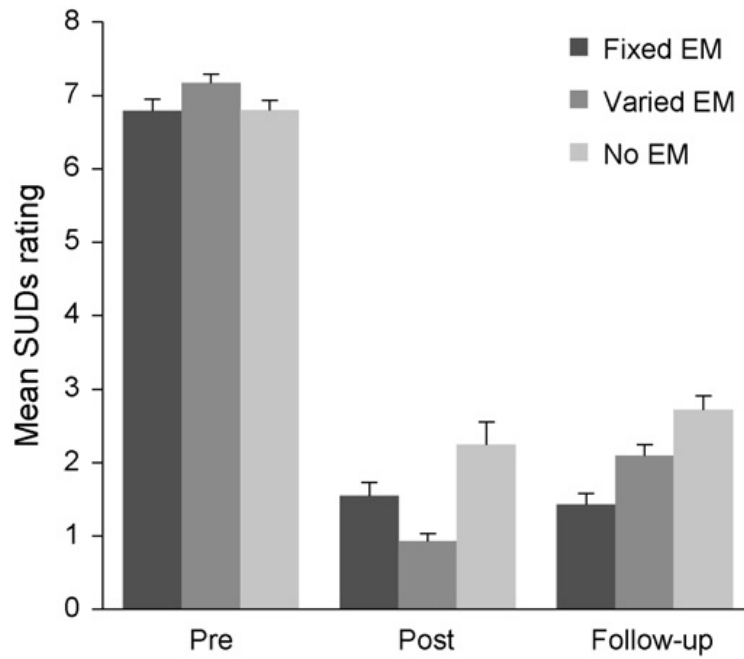
Fig. 1. Mean SUDs ratings for each condition at pre- and post-treatment, and at follow-up. Error bars represent standard error of the mean (SEM).
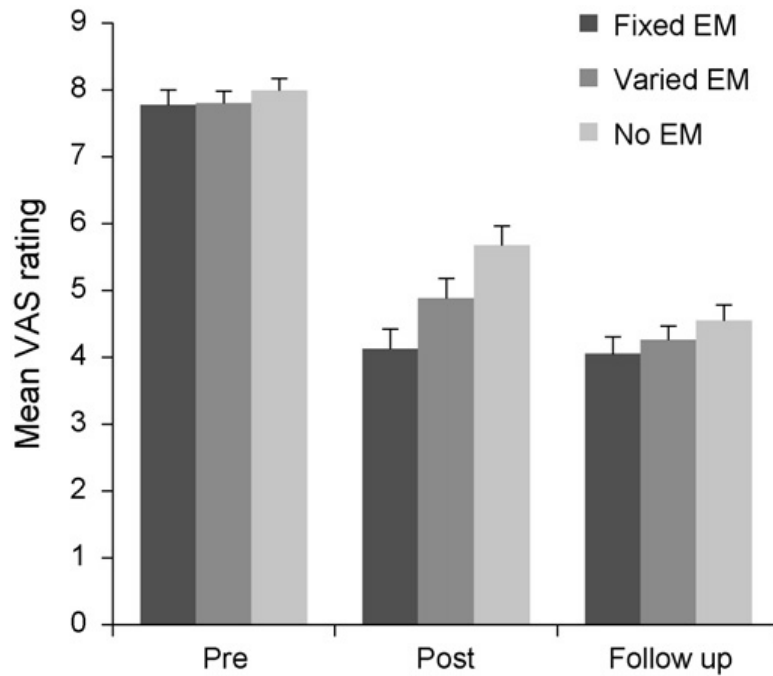

Fig. 2. Mean VAS ratings for each condition at pre and post-treatment and at follow-up. Error bars represent SEM.

3.3. Psychophysiological trends from before to after EMDR treatment

First, trends in physiological data were examined using repeated measures ANOVAs, and significant effects were examined based on hypotheses using oneway ANOVAs with planned contrasts at each time point. With the exception of an elevation in the EM fixed over the EM-varied condition in the size of skin conductance responses in the first 10 s of the first three sets of the EMDR session, no significant differences were found between changes in autonomic responses for the EM-fixed and EM-varied conditions when examining trends from before to after treatment, during stimulation periods, or when examining the number of skin conductance responses within treatment. Therefore, to investigate the effect of the eye movement component in EMDR, the analysis from this point on compared the physiological changes in both EM conditions to responses in the no-EM condition.

Psychophysiological changes within treatment sessions were examined using repeated measures ANOVAs to investigate changes in each physiological variable from before to after treatment during the rest period measured immediately before and after the desensitization phase. The analysis revealed a significant decrease in HR, $F_{1, 60} = 10.38$, $p = .002$, $n^2_p = .15$, and SC, $F_{1, 60} = 23.38$, $p < .0005$, $n^2_p = .28$, across the treatment session, and a significant increase in HRV, $F_{1, 57} = 5.48$, $p = .02$, $n^2_p = .09$. Although RR appeared to decrease within the session, the reduction was not significant, $F_{1, 60} = 3.12$, $p = .08$, $n^2_p = .05$. Overall, these findings indicate physiological dearousal from before to after treatment, consistent with the reduction in subjective ratings of distress (SUDs). Time by condition interactions were non-significant for SC, RR, or HRV measures, indicating that the changes in physiology were similar in the EM and no-EM conditions. However, for HR the time by condition interaction approached significance, $F_{1, 60} = 3.73$, $p = .058$, $n^2_p = .06$. Post hoc analyses using paired t-tests revealed that the decrease in HR from before to after treatment was significant for the EM condition, $t41 = 4.61$, $p < .0005$, $d = 1.44$, but in the no-EM condition the decrease was not significant, $t19 = 0.76$, $p = .46$, $d = .35$ (see Table 1).

Changes within treatment sessions were also examined by comparing the physiological variables during the first three stimulation periods to the last three stimulation periods of each session. Again, the analysis revealed a significant decrease in HR, $F_{1, 59} = 5.17$, $p = .03$, $n^2_p = .08$, SC, $F_{1, 57} = 16.91$, $p < .0005$, $n^2_p = .23$, and RR, $F_{1, 60} = 10.89$, $p = .002$, $n^2_p = .15$, within the treatment session. However, there was no significant change in HRV, $F_{1, 52} = 0.30$, $p = .86$, $n^2_p = .01$. A significant time by condition interaction was noted for changes in RR, $F_{1, 60} = 12.72$, $p = .001$, $n^2_p = .18$. Post hoc analyses using paired t-tests revealed that there was a significant reduction in RR for the EM condition, $t41 = 6.25$, $p < .0005$, $d = 1.02$, but not in the no-EM condition, $t19 = -0.45$, $p = .88$, $d = -.20$ (see Table 1).

These findings suggest that all EMDR conditions led to improvement in SUDs and physiological dearousal, but different processes occurred in EMDR when EMs were used compared to when EMs were omitted. To further explore this possibility, physiological correlates of the EM component in EMDR were examined during stimulation periods within the desensitization phase of EMDR.

3.4. Psychophysiological changes during stimulation within EMDR treatment sessions

Applying repeated measures ANOVAs, significant time effects were noted for all physiological variables (see Table 2). Time by condition interactions were significant for RR, approached significance for HR, and were non-significant for SC and HRV. Main group effects and within-subject contrasts that compared pre-stimulation values (A) with during-stimulation phases (B, C, and D) revealed the following.

Changes in RR differed between conditions (see Table 2 and Fig. 3). The RR in the EM condition did not change significantly from pre-stimulation to the first 10 s during the set. However, as stimulation continued RR increased significantly. In contrast, when EMs were omitted from the EMDR procedure RR decreased significantly within the first 10 s of the set. RR then began to increase, but it remained lower than the pre-stimulation rate throughout the set. Although the RR in the EM condition suggests physiological arousal during stimulation, all other physiological variables indicate a dearousal response throughout EM sets.

In the EM condition HR decreased significantly during stimulation (see Table 2 and Fig. 4). However, in the no-EM condition the change in HR was not significant. In addition to this, and consistent with presence of an orienting response, a significantly large and pronounced decrease in HR occurred within the first 10 s after the eye movements began in the EM conditions. No significant change in HR occurred during this period when eye movements were omitted. Deceleration in HR in the EM conditions was accompanied by a significant increase in HRV, together indicating decreased physiological arousal and increased parasympathetic activity during stimulation. Although HRV also increased from pre-stimulation to the start of the stimulation period in the no-EM condition, none of the changes in HRV were significant.

Also indicating decreased arousal, SC during stimulation showed a pattern of significant decline both in the EM and no-EM conditions. Although the overall time by condition interaction was non-significant for SC, it is interesting to note that the average SC responses for participants in the EM conditions did not change significantly from pre-stimulation to the first 10 s of the set, whereas in the no-EM condition the decrease in SC was significant. Visual inspection of the data indicated that there were short bursts of increased SC within the first 10 s of stimulation sets. One of the main hypotheses about the working mechanisms of EMDR is that dual-attention

stimulation created by eye movements in EMDR causes de-arousal by eliciting an OR (Elofsson et al., 2008; Sack et al., 2008). The spikes in SC within the first 10 s of stimulation indicate the presence of an OR, and thus warranted further examination.
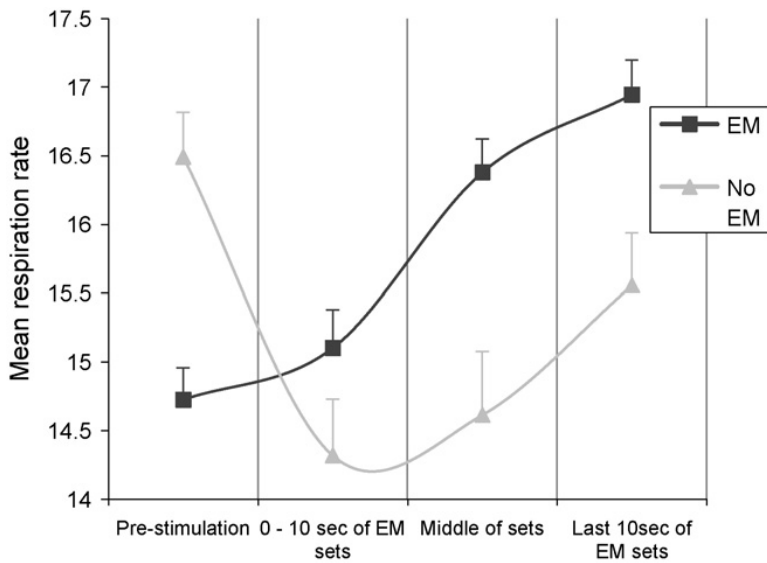
Fig. 3. Mean respiration rate of each condition prior to and during eye movements of the first and last three sets of each session. Error bars represent SEM.
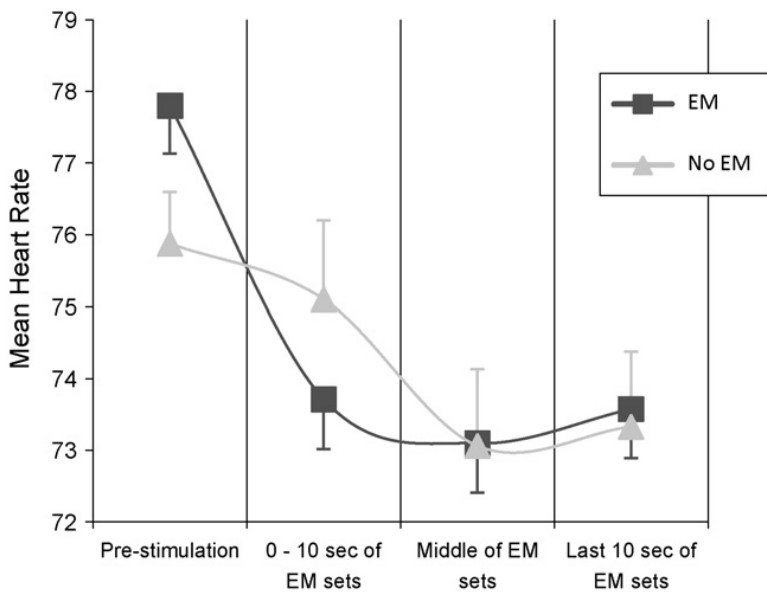
Fig. 4. Mean heart rate of each condition prior to and during eye movements of the first and last three sets of each session. Error bars represent SEM.

Table 1

Means, standard deviations, and statistical comparisons for psychophysiological measures for each condition pre- and post-treatment and during the first three vs last three stimulation periods of each treatment session.

Measure	Condition	BL30[a] pre		BL30 post		Statistical comparison	EM1-3[b] first		EM1-3 last		Statistical comparison
		M	(SD)	M	(SD)		M	(SD)	M	(SD)	
HR	EM	75.33	(10.51)	70.94	(9.14)	***	73.96	(9.38)	72.98	(8.83)	ns
	No EM	73.59	(10.39)	72.48	(9.05)	ns	74.91	(10.08)	73.35	(9.45)	*
SC	EM	2.06	(1.61)	1.58	(1.25)	***	1.80	(1.20)	1.44	(1.03)	***
	No EM	2.45	(1.59)	2.06	(1.34)	**	2.19	(1.24)	1.94	(0.99)	*
RR	EM	15.17	(5.29)	13.13	(3.38)	*	17.31	(3.96)	14.85	(2.87)	***
	No EM	15.19	(3.73)	14.93	(3.58)	ns	14.77	(3.96)	14.87	(3.82)	ns
HRV	EM	33.70	(16.23)	39.40	(16.77)	**	34.03	(13.88)	34.39	(13.40)	ns
	No EM	47.06	(30.80)	50.19	(24.12)	ns	39.17	(21.44)	38.32	(14.56)	ns

Note: Statistical comparison used paired *t*-tests. *sig. at .05, **sig. at .01, ***sig at .001, ns = not significant.

[a] BL30 indicates the 30 s baseline measurement period immediately pre or post treatment.

[b] EM 1-3 indicates the measurement period where the mean of physiological variables were calculated within the first and last 3 sets of the treatment session

Table 2

Physiological variables pre- and during-attentional stimulation periods.

Variable	Cond.	Stimulation Period														Main effects: Time and interaction				Main group effects: EM and no-EM				Within-subject contrasts		
		Pre.A: -13 to -3 s prior to set		Start.B: 0-10 s of set		Middle.C: between first and last 10 s of set		End. D: final 10 s of set																			
		M	(SD)	M	(SD)	M	(SD)	M	(SD)	F	(d.f.)	P	η_p^2	F	(d.f.)	P	η_p^2	A/B	A/C	A/D
HR	EM	77.80	(8.70)	73.71	(8.98)	73.10	(8.91)	73.58	(8.85)	T:21.12	(1.56,93.60)	.000	0.251	45.02	(1.85,75.75)	.000	0.523	***	***	***
	NoEM	75.87	(6.43)	75.10	(9.79)	73.06	(9.57)	73.33	(9.38)	I:3.25	(1.56,93.60)	.055	0.051	2.54	(1.4,26.61)	.113	0.118	ns	ns	ns
SC	EM	1.72	(1.15)	1.69	(1.12)	1.61	(1.05)	1.54	(1.02)	T:42.26	(1.46,87.42)	.000	0.413	32.06	(1.45,59.52)	.000	0.439	ns	***	***
	NoEM	2.22	(1.14)	2.12	(1.09)	2.05	(1.04)	2.00	(1.03)	I:1.13	(1.46,87.42)	.313	0.018	14.89	(1.45,27.55)	.000	0.439	**	***	***
RR	EM	14.73	(3.03)	15.10	(3.59)	16.38	(3.15)	16.95	(3.27)	T:8.09	(2.55,152.96)	.000	0.119	16.18	(2.48,101.67)	.000	0.283	ns	***	***
	NoEM	16.49	(2.91)	14.32	(3.67)	14.61	(4.12)	15.56	(3.42)	I:12.76	(2.55,152.96)	.000	0.175	8.29	(2.41,45.87)	.000	0.304	***	**	ns
HRV	EM	31.25	(10.96)	35.57	(15.13)	36.43	(15.91)	37.66	(20.28)	T:4.83	(2.62,144.14)	.005	0.081	5.10	(2.32,88.21)	.006	0.118	*	**	*
	NoEM	36.76	(15.03)	42.21	(22.02)	41.65	(20.78)	40.40	(20.73)	I:0.53	(2.62,144.14)	.526	0.009	1.50	(2.34,39.83)	.234	0.081	ns	ns	ns

Note. Main effects analysis used repeated measures ANOVAs. As the assumption of sphericity was violated, results reported use Huynh-Feldt. T = main effect of time. I = main effect of the time by condition interaction. Within-subject contrasts (Bonferroni corrected for multiple testing): ns = non significant, $*p < .05$, $**p < .01$, $***p < .001$.

3.5. Skin conductance responses in EMDR: Examining the presence of an orienting response

3.5.1. The number of skin conductance responses

For each participant the SCRs were examined in the first and last three stimulation sets. Based on orienting response theory (Sokolov, 1963), and the knowledge that habituation is a hallmark distinguishing feature of the OR (Zimmer, 2006), if the spikes identified in the SC data represent the presence of an OR it is assumed that as the novel stimulus (the eye movements) continued, habituation to the EMs would occur across the treatment session and within each stimulation set. Thus, if the spikes in SC represent an orienting response there would be more SCRs at the beginning of the session than the end. This was found to be the case for the EM condition, but not for the no-EM condition. To compare the number of SCRs that occurred in the EM and no-EM conditions within the first 3 sets compared to the last 3 sets, a repeated measures ANOVA was used. Results indicated a non-significant effect of time, $F_{1, 60} = 1.19$, $p = .28$, $n^2_p = .02$, and a time by condition interaction that approached significance, $F_{1, 60} = 3.73$, $p = .058$, $n^2_p = .06$. When comparing the number of SCRs in the first 3 sets to the last 3 sets of the session it was found that for the EM conditions combined the number of SCRs decreased significantly from an average of 2.19 (SD = 2.23) responses per minute to 1.41 (SD = 1.36) responses per minute, $t41 = 2.41$, $p = .02$, $d = .75$. For the no-EM condition there was no significant difference in the number of SCRs within the first three sets ($M= 1.29$, SD = 1.15) compared to the last three sets ($M= 1.51$, SD = 1.55) of the session, $t19 =-.70$, $p = .49$.

If the SCRs represent the presence of an orienting response then the number of responses should also decrease within sets as participants habituate to the ongoing presence of the eye movement stimulus. To examine this, number of SCRs per 10 s was calculated for each measurement period (i.e. the beginning, middle, and end of each set) within the first three sets of EMDR for both the EM and no-EM condition. The ANOVA revealed a significant effect of time, $F_{2, 120} = 29.52$, $p < .0005$, $n^2_p = .33$, and a significant time by condition interaction, $F_{2, 120} = 4.61$, $p = .012$, $n^2_p = .07$.

Post hoc analysis using independent t-tests revealed that as predicted, there were significantly more SCRs in the EM conditions ($M= 0.68$, SD = 0.66) than the no-EM condition ($M= 0.37$, SD = 0.36) within the first 10 s of the set, $t58.90 = 2.38$, $p = .01$, $d = .62$ (one tailed). There continued to be significantly more SCRs throughout the middle of the set for the EM conditions ($M= 0.23$, SD = 0.26) than the no-EM condition (M= 0.08, SD = 0.09), $t56.17 = 3.37$, $p = .001$, $d = .90$. As participants habituated to the novel eye movement stimulus, the spikes in SCR within the last 10 s of the set dropped in the EM condition ($M= 0.19$, SD = .30) to be no different from the number seen in the no-EM condition ($M= .20$, SD = .25), $t60 =-0.12$, $p = .90$.

Post hoc analysis using paired-t-tests also revealed that the number of SCRs decreased significantly from the start to the end of the set for both the EM, $t41 = 6.08$, $p < .0005$, $d = 1.90$, and the no-EM, $t19 = 2.36$, $p = .029$, $d = 1.08$, conditions.

3.5.2. The amplitude of skin conductance responses

If the spiked SCRs represent the presence of an OR, the amplitude of the SCRs should also decrease across the session and within stimulation sets (Sokolov, 1963). To investigate this, the amplitude of SCRs in the EM and no-EM conditions was compared in the first and last 3 sets. Results indicated a non-significant effect of time, $F_{1, 60} = .001$, p $= .97$, $n^2_p = .00$, and a non-significant interaction, $F_{1, 60} = 1.20$, $p = .28$, $n^2_p = .02$. The size of the SCRs did not change significantly for the EM conditions from the first three sets ($M= .11$, SD $= .12$) to the last three sets ($M= .09$, SD $= .12$) of the session, $t41 = 1.03$, $p = .33$, $d=.32$. In the no-EM condition there was a nonsignificant increase in the size of the SCRs from the start ($M= .09$,SD $= .12$) to the end ($M= .11$, SD $= .14$) of the session, $t19 =−0.60$, $p = .55$, $d = .28$.

To further determine whether the amplitude of the SCRs decreased within stimulation periods the average size of the SCRs for each measurement period (i.e. the beginning, middle, and end of each set) was compared within the first three sets of each EMDR session for both conditions. The ANOVA revealed a significant effect of time, $F_{2, 120} = 4.54$, $p = .01$, $n^2_p = .07$, and a significant time by condition interaction, $F_{2, 120} = 3.88$, $p = .02$, $n^2_p = .06$. Post hoc analysis using independent t-tests indicated that the size of the SCRs were similar in theEMand the no-EM conditions at the start (EM:$M= .18$, SD $= .19$; no-EM: $M= .11$, SD $= .15$), $t60 =−1.38$, $p = .17$, middle (EM: $M= .12$, SD $= .16$; no-EM: $M= .06$, SD $= .08$), $t59.93 =−1.44$, $p = .08$, and end of the set (EM: $M= .04$, SD $= .08$; no-EM: $M= .10$, SD $= .27$), $t20.58 = 1.00$, $p = .33$. However, post hoc analysis using paired t-tests revealed that the amplitude of the SCRs decreased significantly from the start to the end of the set for the EM conditions, $t41 = 5.19$, $p < .0005$, $d = 1.62$, but the change in SCR amplitude in the no-EM condition was non-significant, $t19 = .15$, $p = .88$, $d = .07$.

4. Discussion

This study was designed to examine effectiveness and psychophysiological correlates of different dual-attention tasks used in EMDR. The study is unique as it used a single EMDR session, with either fixed or varied rate EMs, and compared results to a no-EM control, thus allowing for changes to be attributed to the effects of the eye movement component in EMDR. We found that a single EMDR session was effective at reducing the distress associated with negative autobiographical memories. We also found that the EM component in EMDR was beneficial, and was coupled with distinct psychophysiological changes that may aid in processing negative memories.

As hypothesized, when EMs were used in EMDR there was a greater reduction in distress associated with negative memories than when EMs were omitted from the procedure. In this study no difference in effectiveness was seen when either fixed or varied rate EMs were used in EMDR. This research demonstrated that EMDR is associated with significant physiological dearousal within treatment. This study also established that the EMs in EMDR are accompanied by a number of physiological changes: HR decreased significantly at the onset of the EMs; SC decreased during EM sets; HRV increased significantly; RR increased during EM sets; and orienting responses were more frequent in the EM conditions than in the no-EM condition at the start of exposure.

4.1. The effects of eye movements vs. no eye movements in EMDR

The finding that a single session of EMDR-with EMs reduced self-reported distress associated with negative memories is consistent with Shapiro's (1989) initial findings that introduced the procedure. Current results also support findings by Wilson et al. (1996) and Lee and Drummond (2008) who found that a single session of EMDR-with EMs leads to greater reductions in SUDs associated with distressing memories than EMDR-without EMs, and this effect was maintained at follow-up.

While several other treatment studies have compared EMDR with EMs to EMDR-without EMs and found noticeable differences in within-session SUDs decreases (i.e. Boudewyns, Stwertka, & Hyer, 1993; Montgomery & Ayllon, 1994), findings of several studies contradict ours by demonstrating that EMDR-with or - without eyemovementsleads to significant positive, but equivalent treatment effects (Pitman et al., 1996; Renfrey & Spates, 1994; Sanderson & Carpenter, 1992). To date, research that has compared EMDR-with EMs to EMDR-without EMs has been difficult to interpret due to methodological issues. For example, Sanderson and Carpenter (1992) used a simplified version of the EMD procedure that removed cognitive aspects of the treatment, and asked participants to remain focused on the feared image. The therapy integrity level in Pitman et al. (1996) was low to moderately acceptable, and their no-EM condition had the therapist still administer hand movements while participants' eyes were open but fixed, and simultaneously engage in a tapping task. Similarly, other studies have replaced the EMs in no-EM analogue conditions with alternative dual-attention tasks, rather than simply including a comparison eyes closed, exposure only control. In addition, research has often used small sample sizes, and treatment dose has varied between conditions (i.e. Renfrey & Spates, 1994).

Whilst our findings of greater reductions in distress following EMDR-with EMs compared to EMDR-without EMs is consistent with some, but not all treatment studies, our findings are consistent with analogue studies that have examined the effects of only 8 to 96 s of eye

movement on negative autographical memories of non-clinical participants. Greater reductions in distress for EM over no-EM conditions have been consistently found (Andrade et al., 1997; Barrowcliff et al., 2004; Kavanagh et al., 2001; van den Hout et al., 2001; Kemps & Tiggermann, 2007). These non-clinical studies also often reported that thinking of a negative memory and engaging in EMs led to significantly greater reductions in the vividness of memories than exposure with no-EMs. Recently, Lilley, Andrade, Turpin, Sabin-Farrell, and Holmes (2010) have replicated and extended the findings of analogue studies as they demonstrated that EMs, compared to no-EMs or a verbal task, reduced the distress and vividness of trauma images from a clinical population of PTSD patients awaiting treatment.

The rapid reduction of distress and vividness associated with negative memories using EMDR has also been noted by researchers who have used a single EMDR session to treat PTSD (Rogers et al., 1999). Despite EMDR being an effective intervention for rapidly reducing the intensity of negative memories, and that EMs appear to add to this effect, what remains unclear is what type of EMs work best in EMDR. This study showed no significant difference in effectiveness when the therapist used fixed or varied EMs. The only other research that has compared the effects of EMs of different rates on memory processing was by Maxfield et al. (2008). They found that compared to no-EMs, slow and fast EMs led to significantly decreased ratings of memory vividness and emotionality, and fast-EMs led to greater decreases than slow-EMs. Maxfield et al. (2008) concluded that her findings support the working memory model of EMDR. She argued that fast EMs are more difficult to perform and more taxing on the visual spatial sketchpad component of working memory. Further research is needed to examine why certain types of EMs, or other bilateral tasks, lead to different effects on memory processing. As yet, no study has measured how much dual attention tasks in EMDR tax working memory, or to what degree certain tasks generate ORs. Research has also shown that saccadic EMs have greater effects on memory processing over smooth pursuit EMs (Christman et al., 2003), but research is yet to examine to what extent different EM tasks create saccadic movements during EMDR. Future research should also examine how much these aspects of dual-attention tasks relate to EMDR treatment outcome.

4.2. The physiological effects of EMDR and correlates of the EM component within sessions

Evident from this research is that EMDR is associated with significant dearousal within sessions, and that the EM component in EMDR evokes physiological changes that may aid in processing negative memories. This study demonstrated that EMDR led to dearousal from before to after treatment on all physiological variables examined (HR, HRV, SC, and RR), and the reductions in HR and RR were greater for theEMcompared to the no-EM condition. Thus,

the findings support previous research (Aubert-Khalfa et al., 2008; Sack et al., 2007; Wilson et al., 1996) that reported physiological dearousal within EMDR sessions.

Surprisingly, empirical research that has examined the processes that occur during treatment of PTSD patients is scarce. This study demonstrates that onset of the EM component was associated with an immediate decrease in HR during EMDR treatment in a non-clinical sample. This was also observed by Sack et al. (2008) and Elofsson et al. (2008) who used EMDR to treat PTSD patients. However, these findings extend those of past research, as it can be concluded that the decrease in HR is a distinct feature of the EMs because in the no-EM condition HR did not decrease significantly at the onset of exposure sets. In this study, HR continued to decrease slightly across the set when EMswere used, then increased slightly towards the end of the set. This is also in accordance with past findings (Elofsson et al., 2008; Sack et al., 2008). Like Elofsson and Sack, we attribute the changes in HR at the beginning of EM sets as concomitants of an orienting response (Obrist, 1981; Öhman et al., 2000; McCulloch and Feldman, 1996).

Consistent with an OR, the dearousal at the onset of the EMs, as indicated by reduced HR, was coupled with an increase in HRV, which for both EM and no-EM conditions continued to rise, indicating an increase in parasympathetic tone within EM/exposure sets. In an orienting response SC should increase but habituate quickly. In this study SC decreased from the start to the end of EM/exposure sets for both conditions. Although there was no significant interaction between the EM and no-EM conditions in relation to SC changes, an interesting difference was that within the first 10 s of the set the decrease in SC in the EM condition was non-significant and less than the significant decrease in the no-EM condition. Also, within the SC data, short, sharp increases of SC that resolved quickly were recorded. The OR is characterized by short increases in SC that habituate quickly, while simultaneously sympathetic activity decreases (reflected by decreased HR) and parasympathetic tone increases (reflected by increased HRV). This was seen in our data; however, if the observed bursts in SC were ORs, then, according to OR theory (Sokolov, 1963; Zimmer, 2006) the number and amplitude of the SCRs should habituate both across the EMDR session and within EM/exposure sets.

We found that the number of SCRs decreased significantly from the start to the end of EMDR sessions for the EM condition, but not for the no-EM condition. Also at the start of treatment the number of SCRs was greater at the beginning of sets for the EM compared to the no-EM condition, but by the end of the sets the number of SCRs decreased in the EM condition to be the same as in the no-EM condition. In addition, at the start of treatment the amplitude of the SCRs decreased significantly within the stimulation sets only for the EM condition. This pattern of response is consistent with habituation to the eye movement stimulus both across the treatment session and within each stimulation set. However, contrary to OR theory, the

amplitude of the SCRs did not decrease significantly from the start to the end of treatment for the EM condition. Although SC is the most sensitive and commonly used measure of the OR, the low novelty value of the EMs may not have created ORs large enough to allow for the detection of changes in SCR amplitude across the session.

Reduction seen in the number of SCRs within EM sets and EMDR sessions indicates the presence of ORs. However, as this is the first study to examine the number and amplitude of SCRs during EMDR, further investigation of SC activity is required. It is important for future research to examine specific changes in SC as opposed to just examining mean SC responses during measurement periods of interest within EMDR sessions, as mean SC responses do not provide information about the presence of brief orienting responses and the role that they may play in the EMDR process.

In this study and past EMDR treatment studies (Sack et al., 2008; Elofsson et al., 2008), the physiological changes associated with EMs were consistent with the presence of a relaxation response. At the onset of EMs there was a clear decrease in sympathetic indices and an increase in parasympathetic tone. However, in contrast to the other physiological trends, the EMs were also associated with an increase in RR. In this study the increase in RR was not significant within the first 10 s of the EMs, but RR increased significantly by the end of EM sets. Increased RR is distinct to the EMs in EMDR as when the EMs were omitted from the procedure RR decreased significantly at the onset of exposure sets, and remained significantly lower than the pre-stimulation phase throughout the exposure set.

The increase in RR associated with the EMs in EMDR remains unexplained. Wilson et al. (1996, p. 224) noted that the "respiration tracked and matched the rhythm of the eye movements in a shallow regular pattern." Sack et al. (2008) argued that the physiological correlates of the EMs were a result of a biphasic reaction in which an OR was first dominant but during ongoing exposure a stress-related psychophysiological response emerged. Based on Stickgold's (2002) theory of EMDR, Elofsson et al. (2008) suggested that the increase in RR maybe the result of the EMDR procedure inducing a REM- like state, as the EMs in REM-sleep are associated with rapid shallow breathing. Stickgold proposed that repeated EMs during EMDR creates constant redirecting of attention which evokes ORs and induces a neurobiological state similar to REM-sleep which facilitates memory processing. REM sleep is a complex state without a well defined autonomic profile, and patients are awake in EMDR, thus it cannot be expected that physiological responses in EMDR be identical to those seen in REM-sleep (Stickgold, 2002). In our data, the increase in RR may represent the presence of an induced state similar to REM-sleep. However, our SC data show a difference between pure REM-sleep and EMDR as ORs were present and tended to show a pattern of habituation. A consistent finding has been that ORs in electrodermal measures are rare during REM-sleep (Johnson & Lubin, 1967; McDonald

& Carpenter, 1975), and when they occur they do not tend to habituate (Johnson & Lubin, 1967; Johnson, Townsend, & Wilson, 1975).

EMDR is a complex therapy with a number of underlying processes simultaneously at play. We argue that the psychophysiological changes associated with the EMs in EMDR are primarily the result of two overlapping yet distinct influences: first, an OR as the EM component begins; and second, as the OR habituates to repeated EM stimulation the physiological profile becomes mixed with a stress, or defense response due to continued exposure to stressful memories. Like Sack and colleagues (2008) we propose dual-attention tasks in EMDR create ORs and short-term dearousal which may aid in the processing and integration of trauma memories. Also, through the process of reciprocal inhibition, in which a relaxation response is paired with exposure to distressing memories, negative appraisals of distressing memories weaken, and avoidance of trauma memory processing decreases. Eye movements, as a dual-attention task, may also reduce distress to a tolerable level and create a cognitive and physiological state in which effective processing of trauma information can occur. The relaxation response associated with EMs in EMDR is clinically meaningful as it may serve to moderate arousal throughout treatment sessions. Thus, EMDR may be particularly suitable for patients who cannot tolerate the high stress associated with exposure.

4.3. Limitations

This study compared EMDR-with EMs to EMDR-without EMs in a non-clinical sample. The extent to which these findings apply to a clinical population is yet to be tested. However, the physiological changes seen during EMDR in this study were similar to the changes seen in past EMDR treatment research with PTSD patients (Elofsson et al., 2008; Sack et al., 2008; Wilson et al., 1996). A further limitation was that the therapeutic procedures were administered by the researcher. However, measures were taken to assess experimenter biases and treatment expectancies. No difference was found between conditions in how much participants expected the treatment to reduce the distress associated with their chosen memory. Nor was there any difference in how confident participants perceived the therapist to be in the treatment they received. In addition, reductions in physiological arousal corroborated reductions in self-reported distress.

Although research is now beginning to further explore the specific processes and the physiological changes that occur in EMDR, research is yet to examine the physiological changes that occur during treatment of PTSD patients with EMDR versus behavioural exposure therapy. More research is also required to understand the precise role of the EMs and other forms of dual-attention stimulation used in EMDR. The physiological correlates of alternate

bilateral stimulation (i.e., tones and tapping) have yet to be examined, and further investigation is needed to ascertain why certain dual-attention tasks are more effective than others.

Despite EMDR being an efficacious treatment for PTSD, and research indicating that the EM component in EMDR is beneficial, our understanding of the mechanisms that underlie effective therapy remains incomplete. An understanding of treatment mechanisms that underlie EMDR may lead to refinements in the therapeutic procedure, and also enhance our understanding of processes involved in development and resolution of trauma.

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Summary and link to next chapter

In the research in chapter 3, "the efficacy and psychophysiological correlates of dual-attention tasks in eye movement desensitization and reprocessing (EMDR)", it was proposed that the findings needed replication in a clinical sample. With the lack of controlled EMDR research in real-world, cross-cultural, post-war/conflict populations, and with connections in Timor Leste, the next project became an investigation of the effectiveness and underlying mechanisms of EMDR therapy in Timor Leste. Publications of findings are presented in chapter 4, "the effectiveness of eye movement desensitization and reprocessing (EMDR) to treat symptoms following trauma in Timor Leste" and chapter 5, "eye movements matter, but why? Confirmatory psychophysiological correlates of EMDR to treat trauma in Timor Leste". Publications do not allow for discussion about the challenges encountered in planning and conducting real world trauma treatment research cross-culturally. A discussion on the experience of planning cross-cultural research is presented with the aim to place the two publications (in chapter 4 and 5) in the wider context from which they evolved.

The Timor Leste context

Timor Leste is situated 300km north east of Australia. Timor Leste has a long history of political and social insecurity and a past marked by extraordinary levels of conflict, foreign invasion, oppression, exploitation, and genocide (CAVR, 2005). Originally colonised by the Portuguese, Timor was invaded by Indonesian military forces in 1975. Indonesia occupied the territory for 24 years. This period saw widespread human rights violations including massacres, extrajudicial killings, forced displacement, death from starvation and preventable diseases, enforced disappearances, false imprisonments, arbitrary detention, torture, sexual violence, and mass sterilisation of women (CAVR, 2005; Modvig et al., 2000). During this time it is estimated that a quarter of the 800,000 population was murdered or died of famine, malnutrition, or disease (Kiernan, 2003; Silva & Ball, 2005). This is the worst massacre, per capita, in recent history, higher than the Holocaust or the Pol Pot violations. Surviving women in particular paid a horrific price: many were widowed; many had been raped and tortured; and for many their children had been killed or died of disease and forced starvation (CAVR, 2005). In 1999 Timorese people voted for their independence. In response pro-Indonesian militia groups embarked on a final rampage of killing and burning across Timor. As a result, 80% of infrastructure was damaged or destroyed and 70% of the population was displaced (Australian Parliament Senate Foreign Affairs, Defense, Trade References Committee, 2000). With aid from the United Nations, independence was established in 2002. Timor, one of the world's newest nations, remains one of the least developed in the world (United Nations Development Program, 2006). Timor remains prone to conflict, vulnerable to natural disasters, health services

are limited, and many people who experienced trauma continue to suffer its effects (Silove & Rees, 2008).

Post 1999, an assessment of the prevalence of torture in Timor was conducted (Modvig et al., 2000). It was reported that almost all (97%) Timorese people had experienced a traumatic event and 34% were classified as having PTSD. Although many humanitarian agencies world-wide 'rushed-in' post 1999, many also 'rushed-out' to attend to new emergencies elsewhere. Assessments of Australian funded mental health services in Timor Leste in 2008 revealed that there was still a large residual group that suffered a chronic form of PTSD, and mental disorder continued to account for a disproportionate amount of the disability in the community (Silove & Rees, 2008). Prior to 1999, due to years of occupation and mass conflict, the country had no mental health professionals or specialist services. Since 1999 new health services in Timor Leste were challenged by minimal resources and limited skills. Although the Timorese regard mental health as a priority (Martins da Silva & Kendall, 2002), in 2008 the number of workers in the newly established Mental Health Program (Saude Mental) was only 15 (Silove & Rees, 2008). Thus, in Timor Leste there was a very low proportion of mental health clinicians to the general population, which meant that despite symptoms of PTSD being widespread (Silove & Rees, 2008) the majority of people with severe mental disorder did not receive treatment. This meant reduced ability to rebuild individual lives, recover communities, and reconstruct the country. There was, and still is, a place for effective trauma treatments in Timor Leste.

Planning to investigate the experience of and treatment for trauma in Timor Leste

Challenges ethically, practically, logistically, and financially resulted in a 2 year research planning phase for the research conducted in Timor Leste. The primary planning tasks were: making and maintaining collaborative relationships in Timor Leste; identifying and addressing cross-cultural issues; obtaining permissions; and ongoing re-evaluation of research goals.

Establishing and maintaining collaborative relationships in Timor Leste

Respectful, trusting, and authentic relationships with prospective individuals, organisations, and key stakeholders in the local community were essential to ensure that local values, perspectives, and concerns for participants were reflected in all aspects of the project. Local stakeholders included those in the area of heath that were service providers, leaders, individuals working in the area of health, and government advisors and officials. Without these relationships this project would not have eventuated. Working in a complex environment, with vulnerable individuals cross-culturally, encouraged a new way of thinking about and adapting to challenges faced in planning research.

Cross-cultural research is fundamentally built on relationships, and the responsibilities you hold towards another in a relationship (Bergum & Dossetor, 2005). Relational ethics is about establishing relationships in the planning phase of a project that are entered into with mutual respect, equality, engagement to learn and understand, awareness of power and vulnerability issues, and sensitivity to wider historical and current social situations, with recognition of interconnectedness, in that any decisions or actions made may affect not only individuals, but also families and the community (Bergum & Dossetor, 2005). The relationships built during planning were vital in guiding the process of obtaining permissions, practically providing such things as an appropriate venue, trustingly referring suitable and willing participants, and giving valuable time, support, and guidance throughout the project. An essential aspect in planning, and key to establishing local relationships, was hiring a local person, trained in mental health, and with extensive knowledge of and experience working in the area of health in Timor Leste. Having someone familiar with local organisations, people, politics, religion, social institutions, culture, customs, language, and someone with similar experiences as potential participants was invaluable. This local contact person for the project was important for identifying and solving ethical and practical dilemmas posed in designing and implementing the research.

Identifying and addressing cross-cultural issues

In an attempt to foresee possible issues, a logistical framework was used in planning to anticipate problems relating to research objectives and to devise strategies to mitigate these circumstances where possible (see Appendix D. The logistical framework for an overview of tasks, assumptions, and action taken to overcome challenges in phases of the research after arriving in Timor Leste). In recognition of unforeseeable problems, cross-cultural research needs to be flexible in design (i.e. allowing for extended time, changing locations, changing conditions, budgetary allowances etc.), primarily to allow for the capacity to negotiate solutions to problems as they arise whilst also ensuring that participant needs and safety remain priority. Working cross-culturally in a developing country, seemingly simple problems often became complicated, costly, and time-consuming to resolve, largely due to lack of familiarity with environment, language, and available resource options.

Obtaining permissions

In institutions we are bound by well established ethics boards and ethical regulations that have clearly defined principles based on documents such as The Nuremberg Code (1949) and the World Medical Association Declaration of Helsinki Agreement of 1964. In addition, clinical trials have registries, i.e. Australian New Zealand Clinical Trial Registry (ANZCTR). Research cross-culturally can involve many more layers of formal and informal permissions; from community leaders and elders, to organisation directors, to local ethics boards, and government permissions.

Whist planning the Timor Leste research, in 2010 the first ethics board was being established in Timor Leste by The Cabinet of Health Research and Development (CHRD) under the Government's Ministry of Health (Martins & Hawkins, 2012). The ethics application for this research was the first to be reviewed by the newly established board. The process involved not only a written application, but a face-to-face presentation of the project, both in the local language, Tetun. While the Timorese Ministry of Health made sure that ethics approval had been granted by the University Institutional Review Board in Australia, the Timorese board ensured that the project took into account other ethical factors relating to potential subjects in Timor Leste, for example, specific cultural and religious factors. The board also ensured Timorese nationals were involved as research assistants, ensuring the strengthening of local capacity to conduct research projects themselves by experience gained though "learning by doing" (Martins & Hawkins, 2012).

The Timorese Ethics board highlighted that although international guidelines are necessary, they may be insufficient when it comes to cross-cultural research for ensuring minimal risk and maximising benefits to participants, or recognising the importance of relationships in cross-cultural research. In reference to ethics in indigenous and other marginalised communities, Smith (2008, pp. 128-129) highlights the following about relational ethics in cross-cultural research:

Research ethics is at a very basic level about establishing, maintaining, and nurturing reciprocal and respectful relationships, not just among people as individuals but also with people as individuals, as collectives, and as members of communities, and with humans who live in and with other entities in the environment. The abilities to enter preexisting relationships; to build, maintain, and nurture relationships; and to strengthen connectivity are important research skills in the indigenous arena. They require critical sensitivity and reciprocity of spirit by a researcher.

It is local community members that will grant permission, trustingly refer participants, teach, inform, guide and direct, provide support, and give their valuable time when asking permission to seek local knowledge.

Ongoing re-evaluation of research aims and goals.

Throughout planning, the overall aim of the project was to explore the experience of and recovery from traumatic events in Timor Leste. The project had three general objectives:

1. To explore the specific experience of trauma in Timor Leste as it is mediated by the personal and cultural meanings people attribute to it.
2. To devise and deliver a participatory training package for mental health workers in Timor Leste that focused on understanding, and ways to effectively manage trauma symptoms.
3. To examine if EMDR could be used effectively to treat symptoms of PTSD in Timor Leste.

The first general objective was a qualitative interview study (phase 1) (Butler, 2011). Participatory training was delivered throughout phase 2, which was the EMDR therapy trial (see figure 1). Without phase 1 and the training, the treatment trial would not have taken place. The aims and goals of the interview study and training did not change throughout the research. However, the treatment trial design changed for ethical, practical, and cultural reasons.
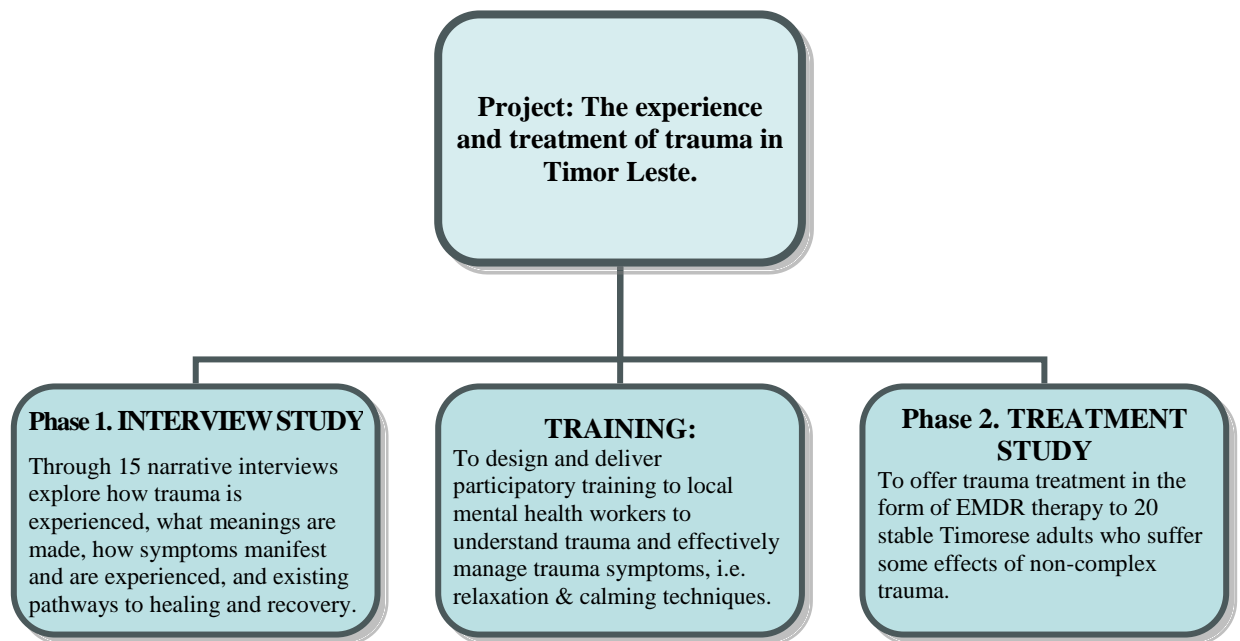
Figure 1. Overview of the trauma project in Timor Leste.

The Interview study was required as responses to the experience of trauma are not a straightforward or entirely a universal process. Cultural factors play a crucial role in determining the sufferer's perception of events, levels of distress, and ability to cope. When working cross-culturally one needs to identify the communities' own concept of psychological suffering and to understand local ways of expressing and healing from these experiences. Only then can a meaningful characterization of posttraumatic responses be attained. This understanding then ensures that any treatment offered can be adapted in a culturally appropriate and sensitive way, and not impact on existing mechanisms (i.e. rituals, behaviours, norms) and pathways to healing. The aim of phase 1 was, through analysis of narrative interviews, to explore the specific experience of trauma in Timor Leste as it is mediated by the personal and cultural meanings people attribute to it (Butler, 2011). Personal narratives gave voice to Timorese people and provided an understanding of: what constituted a traumatic life event in Timor Leste, and what meaning was made of such events; how trauma-related symptoms manifested, were experienced, and expressed; local indices of distress and coping, and how individuals and communities interpreted and responded to these; and what cultural belief systems underlie approaches and expectations of healing and recovery from traumatic experiences. For findings of this research see Butler (2011).

Participatory training evolved out of reciprocity, of wanting to give something back to local organisations that assisted with aspects of the research in Timor Leste. The training, however, became a means to further understand local indices of trauma and pathways to healing. Overall, the participatory training aimed to transfer knowledge and skills in relation to culturally relevant indices of trauma and effective management of trauma symptoms. The training was not an exercise in transplanting Western cultural understandings of trauma, nor was the aim to simply educate. A participatory training method encouraged active participation and reflexivity to create valuable and culturally relevant knowledge that could be used to inform effective work practices in the area of health (Liamputtong, 2010). The training was a time and space for researchers to listen, to learn, to understand the struggles associated with trauma in Timor Leste, and to hear the difficulties and successes health workers experience in their work helping those who suffer. Organisations were provided with the training package, which included learning resources and materials, trauma assessments, and stabilisation skills.[i]

The treatment trial required ongoing re-evaluation of research goals to ensure they stayed achievable, realistic, culturally appropriate and sensitive, and within time and budgetary constraints. In brief, the study aimed to examine the effectiveness of EMDR therapy when used to treat PTSD symptoms in 20 Timorese adults. An additional aim was to examine the underlying mechanisms of EMDR by investigating the psychophysiological correlates of EMDR therapy sessions. Changes in the design (outlined in the Australian New Zealand Clinical Trail Registry)[ii] occurred for ethical reasons. For example, for safety reasons the waitlist control consisted of a minimal stabilization intervention. Thus, following the initial assessment, and prior to the two week waitlist period, calming techniques were taught to each participant (safe place and calm breathing), and they were encouraged to use the techniques should they feel distressed during the waitlist period. Changes also occurred for practical and financial reasons. For example, the initial design had two treatment conditions following a waitlist period: EMDR-with EMs and EMDR-with tones, with an aim to treat 20 participants in each condition. At the time no study had compared the effectiveness of using EMDR with EMs versus tones in a sample of adults with PTSD symptoms, and still no study has examined the physiological changes evoked by EMDR-with EMs compared to EMDR-with tones. This initial design aimed to demonstrate what form of EMDR was most effective, and aimed to add to our theoretical understanding of EMDR. However, during pre-trial EMDR sessions in Timor Leste, EMDR with tones did not appear to be culturally appropriate, and in the future the equipment required for tones to be used in therapy would not be readily available in Timor Leste. It was decided that EMDR with EMs would be examined in this treatment trial only, and to compare this with the waitlist control. This change still allowed for the examination of the effectiveness and psychophysiological correlates of EMDR in Timor Leste. After all treatment had been conducted and effects followed-up in Timor Leste, De Jong, Ernst, Marques, and Hornsveld (2013) and van den Hout et al. (2012) published research in which the effects of EMs, tones,

and no-EMs (recall only) were examined in an EMDR session with patients diagnosed with PTSD. Both found that eye movements outperformed tones, and were significantly more effective at reducing the distress and vividness of targeted memories compared to recall only. These studies suggest that it is good clinical practice that the first choice of modality is to use eye movements in EMDR therapy when used to treat PTSD, and other mental disorders.

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[i] Out of reciprocity whilst in Timor Leste, two group workshops were also given to residents living in group housing. Managers of two places of accommodation welcomed us as researchers, allowed residents to take part in the treatment research, and aided in providing a room in which treatment could be provided. The workshops, one for children and adolescents, and the other for adults, focused on identifying and understanding trauma related symptoms, and involved engaging in numerous calming techniques. In all stages of the treatment trial, it was essential to give back to those individuals and organisations to show appreciation for their time and support. Giving back involved taking participants (included and excluded) to medical facilities, linking them with and taking them to other community health and disability services, and assisting with completing forms and applications. In addition, to give back to the community, throughout my stay in Timor Leste I identified local Timorese persons with university degrees in psychology, and organised meetings on numerous occasions with the aim to start a peer support network, to share knowledge and resources, and to begin the process of establishing a Psychology Association of Timor Leste.

[ii] The ANZCTR clinital trial registration for this research, application number 12611000239965, is available at:

https://www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=336605&showHistory=true&isReview=true .

Chapter 4   The effectiveness of eye movement desensitization and reprocessing (EMDR) therapy to treat symptoms following trauma in Timor Leste.

Attribution

SJS, CWL, and PD planned and designed the research. Acknowledgement to SRB and Dilyana Datten for assistance during research planning. SJS, supervised by CWL and PD obtained ethics permissions in Australia and Timor Leste. SRB and Dillyana Datten translated the documentation and the face-to-face presentation required to obtain ethics in Timor Leste. Grateful acknowledgment to GT for providing therapy in Timor Leste, along with SJS, with GA as the translator when required. SJS and GA collected and entered all data. SJS conducted all data analysis, interpreted findings, reviewed the literature, wrote the manuscript, and reviewed the manuscript following peer reviews. GA, SRB, and GT did not contribute to the draft or edits of the final paper. CWL and PD supervised, thoroughly revised the manuscript, and approved the final published version.

SJS 75%

ISTSS)) International Society
for Traumatic Stress Studies

The Effectiveness of Eye Movement Desensitization and Reprocessing Therapy to Treat Symptoms Following Trauma in Timor Leste

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Abstract

The effectiveness of eye movement desensitization and reprocessing (EMDR) therapy for treating trauma symptoms was examined in a postwar/conflict, developing nation, Timor Leste. Participants were 21 Timorese adults with symptoms of posttraumatic stress disorder (PTSD), assessed as those who scored ≥ 2 on the Harvard Trauma Questionnaire (HTQ). Participants were treated with EMDR therapy. Depression and anxiety symptoms were assessed using the Hopkins Symptom Checklist. Symptom changes post-EMDR treatment were compared to a stabilization control intervention period in which participants served as their own waitlist control. Sessions were 60–90 mins. The average number of sessions was 4.15 ($SD = 2.06$). Despite difficulties providing treatment cross-culturally (i.e., language barriers), EMDR therapy was followed by significant and large reductions in trauma symptoms (Cohen's $d = 2.48$), depression ($d = 2.09$), and anxiety ($d = 1.77$). At posttreatment, 20 (95.2%) participants scored below the HTQ PTSD cutoff of 2. Reliable reductions in trauma symptoms were reported by 18 participants (85.7%) posttreatment and 16 (76.2%) at 3-month follow-up. Symptoms did not improve during the control period. Findings support the use of EMDR therapy for treatment of adults with PTSD in a cross-cultural, postwar/conflict setting, and suggest that structured trauma treatments can be applied in Timor Leste.

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Timor Leste (East Timor), situated 300 km northeast of Australia, has a long history of political and social insecurity and a past marked by extraordinary levels of conflict, violence, oppression, and genocide (Commission for Reception, Truth and Reconciliation in Timor Leste, 2005). Following the 1999 referendum run by the United Nations, in which Timorese people voted for their independence after 24 years of Indonesian occupation, an assessment of the prevalence of torture in East Timor was conducted (Modvig et al., 2000). Almost all (97%) Timorese had experienced a traumatic event, 57% reported being tortured, 22% witnessed family or friends being murdered, 34% had posttraumatic stress disorder (PTSD), and 20% believed they would never recover from their experiences. In Timor Leste today, as in other low-income, postconflict countries, few services are available for those with mental health issues, despite these issues accounting for disproportionate disability in the community, and a large residue group still suffers a chronic form of PTSD (Silove et al., 2008).

Internationally, two psychological therapies are considered efficacious treatments for PTSD: trauma-focused cognitive- behavioral therapy (CBT) and eye movement desensitization and reprocessing (EMDR) therapy (Australian Centre for Post- traumatic Mental Health [ACPMH], 2013; World Health Organization [WHO], 2013). Most research has examined the effectiveness of these therapies in developed Western populations, and there is less evidence for their use cross-culturally. There is some evidence, however, primarily from uncontrolled research, that EMDR therapy can be effective when used to treat disaster-related PTSD in adults who experienced earthquakes in Turkey (Konuk, Knipe, Eke, Yuksek, & Yurtsever, 2006) and Mexico (Jarero, Artigas, & Luber, 2011), Indian Ocean Tsunami survivors treated in Sri Lanka (Errebo, Knipe, Forte, Karlin, & Altayli, 2008), and other trauma events in Israel (Kutz, Resnik, & Dekel, 2008) and Palestine (Zaghrout-Hodali, Alissa, & Dodgeson, 2008). In addition, earthquake survivors in Turkey and China were treated effectively with single-session behavior therapy (Başoğlu, Şalcioğlu, Livanou, Kalender, & Acar, 2005) and brief narrative exposure therapy (Zang, Hunt, & Cox, 2013). As a treatment for trauma cross-culturally, however, EMDR may have advantages over other psychological therapies (Maxfield, 2008). EMDR therapy relies less on language than other therapy approaches, and it does not require creating a narrative, verbal disclosure of details, reliving traumatic experiences, or homework (Ho & Lee, 2012).

In terms of treating war/conflict-related trauma and PTSD in non-Western developing countries, there is no consensus on what treatment should be offered, and a paucity of research on EMDR therapy and various forms of modified CBT (Dossa & Hatem, 2012) in these settings. Recently, Wadaa, Zaharim, and Alqashan (2010) examined the effectiveness of EMDR therapy for traumatized Iraqi children who had immigrated to Malaysia during the Iraqi war. EMDR therapy effectively reduced PTSD symptoms compared to a control condition. These findings

were consistent with previous research on war-related PTSD in which adult combat veterans from Western countries were treated effectively with EMDR therapy (Carlson, Chemtob, Rusnak, Hedlund, & Muraoka, 1998). Despite all the research on PTSD treatment with EMDR therapy, to our knowledge there is no published randomized controlled research or real-world effectiveness research on the use of EMDR therapy to treat adults with war/conflict-related PTSD in non-Western, developing countries.

This research gap is understandable. Offering targeted therapeutic interventions cross-culturally presents challenges ethically, politically, logistically, and financially. Essential tasks include identifying key stakeholders, establishing connections and building collegial, trusting relationships with local health organizations and workers, attaining government permissions, and overcoming language barriers are just some complexities to solve prior to commencing cross-cultural research (Ager, 1997; Errebo et al., 2008). Targeted interventions, like any community intervention, must also acknowledge the discourses on and debates about war trauma and PTSD (Kienzler, 2008). In this research we recognized that traumatic events occur within the complex interplay of political, socioeconomic, religious, and cultural forces of specific regions. Thus, this study was part of a wider project that explored the experience of trauma in Timorese culture (Butler, 2011), and training that focused on understanding trauma, local idioms of distress, and managing trauma symptoms within Timorese culture was delivered to local health workers.

To date, the use of EMDR therapy or any other treatment for trauma symptoms has not been examined in Timor Leste to our knowledge. Thus, our primary aim was to examine the effectiveness (Singal, Higgins, & Waljee, 2014) of EMDR therapy for the treatment of adults with PTSD symptoms when delivered in real world conditions in Timor Leste. It was hypothesised that EMDR therapy would be more effective at reducing PTSD symptoms than a minimal stabilization intervention provided to participants who served as their own waitlist control.

Specifically, for primary outcome symptom measures (PTSD, depression, and anxiety) the hypotheses were no change from before-to-after the waitlist period, significant reductions from pre- to post-EMDR treatment, and no significant change from posttreatment to follow-up as treatment gains were expected to be maintained. For secondary treatment process measures (the Subjective Units of Distress Scale [SUDS], Wolpe, 1991, and vividness), the hypotheses were significant reductions from before-to-after EMDR sessions, with no significant changes at any following assessments.

Method

This effectiveness study was designed to compare EMDR therapy to a minimal stabilization waitlist control intervention in which, following initial assessment and teaching stabilization techniques, participants served as their own delayed treatment waitlist control. The waitlist period was 2 weeks−equivalent to the estimated time required for treatment to be administered on alternate days (meaning one day between sessions). Posttreatment assessments occurred 2 weeks after the final treatment session, with follow-up at 3 months.

The posttreatment time point was equivalent to the 2-week waitlist period. The dependent variables were PTSD, depression, and anxiety symptoms (assessed at prewaitlist, pre- and posttreatment, and independently from therapists at follow-up); SUDs (assessed within session, at posttreatment, and follow- up); and vividness of targeted memories (measured within sessions before and after memory processing; also, vividness of the first memory targeted in treatment was assessed at posttreatment and follow-up). The design also took into account a secondary aim, which was to assess psychophysiological responses during standard EMDR therapy sessions. This was done in a similar manner to previous EMDR research (Sack, Lempa, Steinmetz, Lamprecht, & Hofmann, 2008; Schubert, Lee, & Drummond, 2011), but is a deviation from the standard delivery parameters. Physiological findings are reported elsewhere (Schubert, Lee, & Drummond, in press).

Murdoch University Human Research Ethics Committee, Australia, and The Cabinet of Health Research and Development under the Ministry of Health in Timor Leste approved the research. The trial was registered with the Australian New Zealand Clinical Trials Registry (Trial No. 12611000239965).

Participants and Procedure

Recruitment was primarily through two key Timorese non- government organisations that focused on community development and health: APHEDA (Australian People for Health, Education and Development Abroad) and PRADET (Psychosocial Recovery & Development in East Timor). Staff of these organisations referred suitable participants. Participants made initial contact via phone. Inclusion criteria were Timorese aged 18–65 years, a traumatic event at least 3 months prior to study entry, reported PTSD symptoms, a trauma symptom scale score ≥2 using the Harvard Trauma Questionnaire (HTQ: Mollica et al., 1992 and some social support. Exclusion criteria were blindness or a history of eye disease. This trial was broadly inclusive to allow the sample to reflect the heterogeneity of the population who may seek treatment for PTSD and its comorbidities in Timor Leste (Singal et al., 2014). Of the 28 participants who responded, 5 were excluded: Four scored <2 on the HTQ, and one had symptoms more

consistent with depression and anxiety than PTSD, as memories of traumatic experiences were not associated with hyperarousal. Sample size was limited by funding constraints, primarily impacting on the time that therapists could reside in Timor Leste, and was largely determined by the practicalities of recruiting and treating in a naturalistic setting.

These 23 participants (16 female, 69.6%) ranged in age from 18 to 57 years ($M = 30.52$, $SD = 11.29$). All participants' native language was Tetun. For 14 study procedures were conducted in Tetun through a translator, and for the 9 others English without a translator was used. This was in English without a translator. What determined the language used in sessions was that if a participant spoke only Tetun, therapy was conducted in Tetun through a translator. If a participant also spoke English and requested treatment in English without use of a translator, this request was met. There were nine participants who worked in skilled employment; two were unskilled workers; four were in posthigh school education; four were in high school; one was engaged in primary school education; and three were unemployed but had completed high school. All participants resided in urban Timor Leste. The mean number of traumatic events reported on the HTQ was 7.09 ($SD = 2.31$). A mean of 7.35 years (range = 3 months to 24 years) had elapsed since targeted traumatic events occurred. Typical memories included war experiences, such as seeing people killed or tortured, losing family members, homes being burnt down, witnessing and avoiding combat, and being threatened by the militia. Other memories related to domestic violence, vehicle accidents, floods, earth- quakes, and witnessing people die. Two participants dropped out during the waitlist period and did not commence treatment, giving a sample of 21 for the analyses.

Participants attended a 2-hr assessment prewaitlist and stabilization intervention. Verbal and written information was provided that explained research rationale and procedures. Written consent was obtained. Information was collected on basic demographics, family, trauma history, and the self-report questionnaires were administered. Social supports and coping resources were assessed, and two stabilization techniques were taught - calm breathing and safe place. These techniques were chosen as they are common precursors to PTSD treatment in prolonged exposure therapy (Foa, Hembree, & Rothbaum, 2007) and EMDR therapy (Shapiro, 2001). Participants engaged in both techniques with the therapist. A handout summarizing the techniques and a list of each individual's coping resources were provided. Participants were encouraged to use calming techniques and their coping resources while they waited 2 weeks prior to commencing EMDR therapy.

In the treatment sessions, EMDR therapy was delivered in accordance with all eight phases of the treatment protocol outlined in Shapiro (2001). Each session (up to a maxi- mum of 10) lasted 60–90 min. The number of sessions was determined by the participant's individual needs. In desensitization sessions conducted in Tetun, to minimize disruption translation may have had

on memory processing, the translator was trained in the protocol in a way that translation of participant responses between EMDR therapy sets could be kept to a minimum. For example, the translator was trained to identify when processing continued to shift or had reached plateau (as the protocol then called for rechecking the target memory), and to highlight new negative emotions (in which the protocol required asking the participant where they noticed associated body sensation). The translator was also aware of the wording required in standard parts of the protocol such as rechecking the target memory, reassessing the positive cognition prior to installation, and instructions for the body scan. Therapists also learned standard, repetitive instructions in the protocol in Tetun, such as "take a breath," "what do you get now," and "stay with that," to ensure that memory processing flowed as much as possible. Participants spoke to both the therapist and translator when sessions were in Tetun. Treatment was free and transportation costs to and from sessions were paid.

Two therapists provided EMDR therapy: Both were clinical psychologists and consultants accredited by the EMDR Association of Australia. One of the therapists conducted all initial assessments. A local Timorese person with tertiary education and experience in community development and health, but no formal training in psychology, was employed as a translator/interpreter and conducted all follow-up assessments. Therapists followed a step-by-step EMDR therapy protocol. Consent was provided by 18 of the participants to video record the EMDR sessions. A consultant approved by the EMDR Inter- national Association randomly chose 12 treatment sessions, including sessions in Tetun, and rated each on a 27-item EMDR fidelity checklist, with items scored on a 7-point scale (1 = *poor*; 7 = *excellent*). The mean rating for each session was 6.08 ($SD = 0.67$).

Measures

The HTQ (Mollica et al., 1992) assessed trauma exposure and symptoms consistent with PTSD. The HTQ was designed for use with trauma-affected populations from diverse cultures, and has been used to assess PTSD in Timor Leste (Modvig et al., 2000; Silove et al., 2008, 2009). Three parts of the HTQ were used. Part 1 listed 17 trauma events, but the item inquiring into rape was omitted due to the cultural inappropriateness of this question (Silove et al., 2009). Participants indicated whether they had experienced each item. Part 2 was an open question that asked participants, "What [do] you consider to be the most hurtful or terrifying events you have experienced?" This allowed discussion of trauma events and their effects. Part 3 included 16 trauma symptom items that reflect PTSD criteria according to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., DSM-IV; American Psychiatric Association, 1994) rated 1 = *not at all*, 2 = *a little*, 3 = *quite a bit*; or 4 = *extremely*. The mean score was calculated, and the recommended cutoff of ≥ 2 to indicate PTSD was used (Mollica, McDonald,

Massagli, & Silove, 2004). Cronbach's α estimation for the HTQ PTSD scale in this setting showed acceptable reliability for screening, α = .73.

The Hopkins Symptom Checklist (HSCL-25; Mollica et al., 1987) measured depression and anxiety symptoms. The HSCL- 25 has 15 depression and 10 anxiety items consistent with the DSM-IV criteria for major depression and generalized anxiety. Item responses are the same as the HTQ Part 3. The recommended cutoff of >1.75, which is considered checklist positive for major depression and generalized anxiety, was used (Mollica et al., 1987, 2004). This cutoff has been empirically validated as a screen for major depression (Silove et al., 2007), but the 10 anxiety items have not been tested as to their diagnostic validity. Cronbach's α estimation for the Depression scale showed strong reliability, α = .89. The reliability estimate for the Anxiety scale, α = .64, was below the minimum α coefficient of .70 recommended for screening (Nunnaly & Bernstein, 1994).

The SUDs (Wolpe, 1991) assessed distress experienced while thinking about targeted trauma memories. SUDs is an 11-point self-report scale (0 = *no distress*; 10 = *highest distress possible*) routinely used to measure change in distress. The scale's validity has been demonstrated, and research has shown it to correlate with levels of depression and anxiety (Kim, Bae, & Park, 2008). The vividness of each target memory was rated. While participants held targeted memories in mind, on a 10-point visual analogue scale (VAS; "How vivid is the image of the memory to you right now?"), they rated the target memory from 10 = *very clear* to 0 = *not clear at all*. This measure is commonly used to rate vividness in EMDR and memory-processing research (Schubert et al., 2011; van den Hout, Muris, Salemink, & Kindt, 2001).

Expectancy and Confidence scales assessed the participant's expectancy of a positive treatment outcome. Pretreatment, participants indicated "how much you think this therapy will help you" on an 11-point VAS (0 = *not at all*, 2.5 = *a little*, 5 = s*omewhat*, 7.5 = *a lot,* 10 = *completely*). At posttreatment, participants indicated "how confident you thought the therapist was that the treatment they used would help you" on an 11-point scale (0 = *not confident*, 10 = *extremely confident*). These scales were similar to those used in previous research (Borkovec & Nau, 1972; Schubert et al., 2011).

All measures were translated and back-translated into Tetun using standard methods (Bracken & Barona, 1991). Measures were translated from English to Tetun by a bilingual Timorese person trained in psychology. These versions were blind back-translated into English by a bilingual Australian familiar with Timorese culture. Translations were compared and discrepancies were resolved by a team of translators.

Data Analysis

Significant effects in primary and secondary measures were ex- amined using multivariate repeated measures analyses of variance (MANOVAs) that incorporated within-subject contrasts to examine a priori hypotheses related to primary symptom   and secondary treatment process measures. For primary measures, the ANOVA incorporated time (four levels: prewaitlist, pre- and posttreatment, and follow-up) as the within-subjects factor, with three within-subjects variables (PTSD, depression, and anxiety). For secondary measures, the ANOVA incorpo- rated time (three levels: before and after memory processing; posttreatment, and follow-up), with two within-subjects variables (SUDs and vividness). When data were missing at posttreatment (one participant) and 3-month follow-up (two participants), analysis of primary and secondary measures used intent-to-treat data with last observations carried forward. Vividness data were missing for one participant who, despite reporting distress related to the targeted traumatic experience, did not hold a visual memory of the experience. In this case, missing data were replaced by the mean vividness score of the whole sample at each time point. When the assumption of sphericity was violated Huynh-Feldt corrected statistics are re- ported. Partial eta squared (η_p^2) was used to report effect sizes for ANOVAs, and Cohen's d for planned contrasts. The criterion of statistical significance was an α level of .05.

Reliable and clinically significant change was assessed for the HTQ PTSD scale and the HSCL-25 Depression scale using methods recommended by Jacobson and Traux (1991).   A reliable change score criterion was calculated using the pretreatment means and Cronbach's α estimation for the PTSD and depression measures in this study. The formula for reliable change score criterion, based on change that would happen less than 5% of the time by unreliability of measurement alone, $1.96 * SE_{diff}$ ($SE_{diff} = SD_1 \sqrt{2} \sqrt{1\text{-}r}$). Thus, PTSD = $1.96 (.45*\sqrt{2}*\sqrt{1\text{-}.725})$, and depression = $1.96 (.63*\sqrt{2}*\sqrt{1\text{-}.887})$. Clinically significant change was calculated using a cut-off of the pretreatment mean less two standard deviations. Data were analysed using SPSS version 21.

Results

The average number of EMDR treatment sessions was 4.14 ($SD = 2.06$, range = 1-10), over an average of 12.95 ($SD = 8.45$) days.

For primary outcome measures, using Pillai's trace, there was a significant overall effect of treatment on symptoms, V = .81, $F(9, 180) = 7.35$, $p < .001$, $\eta_p^2 = .27$. Separate univariate ANOVAs revealed that symptom ratings decreased significantly over time for all measures: PTSD, $F(1.85, 37.06) = 56.50$, $p < .001$, $\eta_p^2 = .74$; Depression, $F(1.63, 32.66) = 52.38$, $p < .001$, $\eta_p^2 = .72$; and anxiety, $F(1.64, 32.74) = 20.87$, $p < .001$, $\eta_p^2 = .51$ (Table 1). Planned contrasts

indicated that symptom scores for PTSD, depression, and anxiety remained stable during the stabilization/waitlist period. Symptom scores decreased significantly from before to after EMDR treatment for all measures: PTSD, $F(1, 20) = 50.57$, $p < .001$, $d = 2.48$; depression, $F(1, 20) = 59.05$, $p < .001$, $d = 2.09$; and anxiety, $F(1, 20) = 27.28$, $p < .001$, $d = 1.77$. Symptom scores at 3-month follow-up showed no significant change from posttreatment for PTSD and anxiety, whereas depression scores continued to decrease, $F(1, 20) = 5.16$, $p = .034$, $d = 0.30$. Decreases in PTSD symptoms were associated with decreases in anxiety ($r = .76$, $p < .001$) and depression ($r = .66$, $p < .001$).

Change that exceeded 0.65 on the HTQ PTSD scale, and 0.59 on the HSCL-25 depression scale, was considered reliable. Reliable reductions in PTSD symptoms were reported by 18 of 21 (85.7%) participants posttreatment, and 16 (76.2%) at follow-up. Reliable reductions in depression symptoms were reported by 16 (76.2%) at both posttreatment and follow-up.

Participants who demonstrated clinically significant improvement were those who scored below 1.35 on the HTQ PTSD scale and below 1.07 on the HSCL-25 depression scale. With this criterion, EMDR led to clinically significant improvement in PTSD symptoms for 16 (76.2%) of the participants at both posttreatment and follow-up, and clinically significant improvement in depression symptoms for 8 (38.1%) posttreatment and 13 (61.9%) at follow-up.

Change in symptoms consistent with PTSD was also examined. The percentage of participants who met the cut-off score of ≥ 2 to indicate PTSD on the HTQ was examined using a McNemar Test with uncorrected χ^2 square statistics. At the end of the waitlist period 17 (81.0%) of the 21 participants continued to score ≥ 2 on the PTSD scale, whereas posttreatment only 1 (4.8%) participant scored above 2 on the PTSD scale. This difference in proportions was statistically significant, McNemar's $\chi^2 = 14.22$, $p < .001$. At follow-up only 2 (9.5%) PTSD scores were above 2, indicating persistent treatment effects in most participants.

For secondary process measures (SUDs and vividness), using Pillai's trace, there was a significant overall effect of treatment, $V = 1.06$, $F(6, 120) = 22.49$, $p < .001$, $\eta_p^2 = .53$. Regarding SUDs, a univariate ANOVA revealed that distress ratings associated with initially targeted trauma memories decreased significantly over time, $F(1.69, 33.83) = 129.78$, $p < .001$, $\eta_p^2 = .87$ (Table 2). Planned contrasts revealed that SUDs decreased significantly from pretreatment assessment to the end of sessions after desensitisation, $F(1, 20) = 526.06$, $p < .001$, $d = 5.85$. This reduction in distress was maintained at posttreatment and follow-up.

In terms of vividness, ratings associated with the initially targeted trauma memory decreased significantly over time, $F(3, 60) = 26.92$, $p < .001$, $\eta_p^2 = .57$ (Table 2). Planned contrasts revealed that vividness ratings decreased significantly from pretreatment to the end of

desensitization in sessions, $F(1, 20) = 23.32$, $p < .001$, $d = 1.11$. Vividness ratings obtained posttreatment did not differ significantly from end of session scores. At follow-up, vividness ratings were significantly lower than those provided posttreatment, $F(1, 20) = 4.54$, $p = .046$, $d = .34$.

Finally, ratings of confidence in therapists were not related to pre-post treatment change scores of SUDs, PTSD, anxiety or depression. Pretreatment expectancy scores correlated significantly, however, with pre-post treatment change scores in PTSD symptoms, $r = .60$, $p = .031$. This finding was difficult to interpret as it is not usual to find correlations in expectancy and treatment outcome in EMDR research (Devilly & Spence, 1999; Lee & Drummond, 2008), and here, expectancy scores did not correlate with any other outcome or process measure.

Table 1

Mean and Standard Deviation at Four Time Points for PTSD, Depression, and Anxiety Symptom Ratings

Variable	*n*	1. Pre-Waitlist *M*	*SD*	2. EMDR *M*	*SD*	3. PostEMDR *M*	*SD*	4. Follow-up *M*	*SD*	*d change* 1–2	2–3	3–4
PTSD	21	2.41	0.40	2.25	0.45	1.29	0.31	1.28	0.36		2.48[***]	
Depression	21	2.51	0.76	2.33	0.63	1.30	0.30	1.20	0.36		2.09[***]	0.3
Anxiety	21	2.14	0.77	2.06	0.50	1.29	0.36	1.24	0.36		1.77[***]	

Note. PTSD = posttraumatic stress disorder symptoms.
[*]$p < .05$. [***]$p < .001$.

Table 2

Mean and Standard Deviation at Four Time Points for Distress and Vividness of First Trauma Memory

Variable	*n*	1. Pretreatment *M*	*SD*	2. End session *M*	*SD*	3. Posttreatment *M*	*SD*	4. Follow-up *M*	*SD*	*d change* 1–2	2–3	3–4
SUDs	21	9.00	0.96	0.96	1.69	1.05	1.99	1.29	2.34	5.85[***]		
VAS	21	7.66	2.96	4.26	3.16	3.08	3.30	2.05	2.81	1.11[***]		0.34[*]

Note. SUDs = substance use disorders; VAS = visual analogue scale.
[*]$p < .05$. [***]$p < .001$.

Discussion

This study examined the effectiveness of EMDR therapy for the treatment of adults with PTSD symptoms in Timor Leste. Treatment with EMDR was followed by significant reductions in PTSD, depression, and anxiety symptoms. EMDR desensitization was also followed by significant decreases in the distress and vividness associated with traumatic memories targeted in sessions. These changes were maintained at 3-month follow-up.

These findings suggested that benefits can be achieved with EMDR therapy for decreasing PTSD symptoms in a postwar, cross-cultural setting in a relatively short period (on average four treatment sessions over 13 days). Although in need of replication, findings are consistent with international treatment guidelines (ACPMH, 2013; WHO, 2013) that recommend EMDR for treatment of PTSD, and offer support for independent reviews, meta-analyses, and controlled research that have examined EMDR and found robust reductions not only in trauma symptoms but also depression and anxiety after similarly few sessions, without use of homework (Carlson et al., 1998; Ho & Lee, 2012). Notably, and warranting further research, was that in this context participants had experienced a large number of traumatic events (seven on average reported on the HTQ) and had trauma memories for a considerable time (the average time since trauma event was 7.35 years), yet treatment effects were experienced very quickly. In this study, desensitization of trauma memories occurred frequently in the first treatment session, in which the distress and vividness associated with targeted trauma memories decreased significantly. This immediate, within-session reduction in distress and vividness associated with trauma memories is consistently reported in EMDR treatment literature (Wilson, Silver, Covi, & Foster, 1996). Cross-culturally, this treatment effect was important as Timorese health workers advised that if participants could not see treatment benefits straight away it was likely they would not engage in the therapy process.

Although there is still no consensus on the use of EMDR or any treatment post-large-scale disaster (Gelbach & Davis, 2007), our findings offer evidence for the use of EMDR cross-culturally. Findings are consistent with research in which EMDR (Jarero et al., 2011; Kutz et al., 2008; Wadaa et al., 2010) and other Western therapies (Başoğlu et al., 2005; Zang et al., 2013) have been used effectively to treat trauma following natural and man-made disaster events cross-culturally. Furthermore, this research supports the small body of naturalistic on-the-ground postdisaster treatment projects that back the use of EMDR in reducing PTSD and depressive symptoms in various cultures. For example, large-scale humanitarian projects have demonstrated that when local health workers in Sri Lanka (Errebo et al., 2008) and Turkey (Konuk et al., 2006) were trained in EMDR to treat survivors of an earthquake, tsunami, and suicide bomb blasts, treatment was effective despite chaotic, postdisaster treatment settings (i.e., in tent cities), transient patients, and where the hierarchy of basic needs of safety and health understandably took priority over psychological care. These naturalistic cross-cultural projects, along with the current study, demonstrate that trauma treatment outcome data and EMDR therapy process data can easily be attained.

Although real-world, effectiveness research is important, research specific to any culture, social context, and time, limits the generalization of findings. Many factors may have contributed to the effectiveness of EMDR therapy for the treatment of trauma in Timor Leste: First, although

Timor as a nation has experienced horrific trauma for almost a quarter of a century, Timor Leste is now a relatively stable nation, well on the path to rebuilding and recovery (International Crisis Group, 2013); second, basic needs such as medical, health, shelter, and food have largely been met; third, traditional mechanisms of community coping have been re-established; and fourth, EMDR therapy created minimal disruption to existing cultural forms of support. If such factors are not in place or considered, targeted therapeutic intervention may be inappropriate (Ager, 1997).

In addition to the social and political context, Timorese culture may also have been a factor that influenced the effectiveness of EMDR. Specifically, the experience of trauma by the Timorese was not private, but rather a collective experience (Butler, 2011). One's sense of self was fundamentally group based, and a common perception was that it was the nation and shared values of the Timorese that were targeted rather than individuals themselves (Butler, 2011). Although no formal qualitative methods were used to assess participants' responses, both therapists observed in postintervention debriefs that religious and spiritual beliefs, rituals, and prayer powerfully shaped how trauma events were perceived, experienced, made sense of, and the way recovery was able to occur. For many participants, traumatic events were interpreted as "God's will." Spirits of the dead were seen to be watching over and protecting as one lived life as a survivor, for whom God had a plan. Religious beliefs appeared to provide hope and gave life purpose and meaning. Although not formally assessed, these observations warrant further investigation. Various models of trauma recovery posit that healing occurs as people make sense of trauma experiences from their own perspective (Janoff-Bulman & Frantz, 1997). As these perspectives are likely to be influenced by cultural factors, narratives from people who reprocess trauma experiences in Timor Leste may well prove different to those from a Western background.

Some Timorese participants also stated they preferred not to have the Timorese translator present due to fears confidentiality would not be maintained. During the civil war in Timor Leste, people betrayed each other and interpersonal trust was eroded (Butler, 2011). Consequently, in this study the presence of a Western therapist may have facilitated a sense of confidentiality. More broadly, the issue of trust and confidentiality pose a significant challenge to the dissemination of therapies, including EMDR cross-culturally (Jarero et al., 2011).

As this study was a real-world, naturalistic intervention, several compromises in the design limit confidence in the interpretation of findings. This is a single-arm study with no separate control condition; thus, factors other than EMDR therapy may account for improvements in trauma-related symptoms. Nevertheless, no significant improvement in symptoms occurred during the waitlist period in which stabilization and calming techniques were taught. As the sample size was small, generalization of the findings is limited. This could be overcome in future larger,

randomized, controlled research trials, with structured formal diagnostic assessment and qualitative data to examine the cultural appropriateness of EMDR in Timor Leste. To conclude, this research is significant as it appears to be the first study to examine the effectiveness of EMDR therapy for the treatment of PTSD symptoms in a postwar/conflict developing country. Findings demonstrated that EMDR therapy, as a structured trauma treatment, could be used effectively in Timor Leste. Our findings may be useful for future cross-cultural humanitarian efforts following war and large-scale disasters. Future research in this area is strongly encouraged, as it is vital to know that any intervention offered to treat trauma symptoms postwar/conflict or disaster in any context not only is harmless and effective, but that it complements survivors' traditional coping strategies.

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Chapter 5   Eye movements matter, but why? Confirmatory psychophysiological correlates of EMDR to treat trauma in Timor Leste.

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Attribution

SJS, CWL, and PD planned and designed the research. SJS collected all data, conducted data analysis, interpreted findings, reviewed the literature, wrote the manuscript, and reviewed the manuscript following peer review. CWL and PD supervised the project, edited and critically reviewed the manuscript, and approved the final published version.

SJS 80%

Eye Movements Matter, But Why? Psychophysiological Correlates of EMDR Therapy to Treat Trauma in Timor-Leste.

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Abstract

This preliminary study examined the physiological correlates of eye movement desensitization and reprocessing therapy (EMDR) when effectively used to treat trauma symptoms in a post-conflict, developing nation, Timor-Leste. Participants were 20 Timorese adults with posttraumatic stress disorder (PTSD) symptoms treated with EMDR therapy. PTSD, depression, and anxiety decreased significantly after an average of 4.15 (SD = 2.06) sessions. Continuous measures of heart rate, skin conductance and respiration were collected during the first and last desensitisation sessions. Physiological activity decreased in EMDR desensitization sessions, and eye movement sets were associated with an immediate significant decrease in heart rate and an increase in skin conductance, consistent with an orienting response. This response habituated within and across eye movement sets. These findings suggest that effective EMDR therapy is associated with de-arousal within sessions, and that eye movement sets are associated with distinct physiological changes that may aid memory processing. The findings offer insight into the working mechanisms of EMDR when used to treat PTSD symptoms in a real world, cross-cultural, post-war/conflict setting.

Keywords: EMDR therapy; mechanisms of action; psychophysiology; orienting response; REM hypothesis; Timor-Leste.

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Eye movement desensitization and reprocessing therapy (EMDR) and trauma-focused cognitive-behavioral therapy (CBT) are recognized internationally as the two most efficacious treatments for posttraumatic stress disorder (PTSD) Australian Centre for Posttraumatic Mental Health [ACPMH], 2013; World Health Organization [WHO], 2013). Still, for both therapies, evidence for their effectiveness in non-Western, postwar/conflict, real world settings is scarce, and the exact mechanisms of change underlying effective treatment remain unknown (Schnyder et al., 2015). What is known is that dysregulated psychophysiological arousal underlies symptoms of PTSD: persistent hyperarousal (i.e. increased resting heart rate); exaggerated responses to startling sounds; and elevated responses to external and internal trauma reminders (Pole, 2007). The increased arousal has been found to disturb sleep and memory processing (Stickgold, 2002). Effective PTSD treatment with both therapies is associated with physiological de-arousal from pre- to posttreatment, reduced psychophysiological activity when trauma memories are recalled (Sack, Hofmann, Wizelman, & Lempa, 2008), and improvements in sleep quality (Raboni, Tufik, & Suchecki, 2006). However, the therapeutic processes that lead to physiological changes and PTSD symptom reduction are not entirely understood.

EMDR therapy (Shapiro, 2001) emphasizes the role of memory and the information processing system in treatment of symptoms resulting from unresolved life experiences. EMDR consists of eight phases, structured in a way to process past, present, and future ramifications of unresolved, or dysfunctionally stored memories. EMDR is an integrative treatment with many underlying processes: cognitive restructuring; mindfulness; free association; psychological distancing; perceived mastery; somatic awareness; and conditioning (Oren & Solomon, 2012). A distinguishing difference between EMDR and exposure therapy is that eye movements (EMs) are used as a dual-attention task during desensitization of trauma memories. Early reviews (Cahill, Carrigan, & Frueh, 1999) and meta-analyses (Davidson & Parker, 2001) questioned beneficial effects of the EM element. However, a recent meta-analysis has demonstrated that the EMs significantly add to the beneficial treatment effects of EMDR (Lee & Cuijpers, 2013).

Eye movement may evoke orienting responses and/or REM-like mechanisms. The orienting response theory of EMDR states that EMs, or other dual-attention stimuli, elicit an orienting response, with associated physiological dearousal that enhances processing of trauma material (Söndergaard & Elofsson, 2008). The orienting response is an autonomic response evoked by any new stimulus that is assessed for threat and reflects an overall increase in physical arousal. With repeated presentation of the same non-threatening stimulus the orienting response habituates quickly (within 10 seconds), indicating a reduction in physiological response to that stimulus (Bradley, 2009).

REM hypotheses of EMDR posit that the EMs, possibly through repeated orienting responses, shift the brain into a memory processing mode similar to REM sleep, which aids integration of

episodic traumatic memories into general semantic networks (Stickgold, 2002). REM sleep plays an important role in internal information processing and memory consolidation. The orienting response and REM sleep both have recognisable physiological characteristics. For example, distinct indices of an orienting response include a biphasic initial startle response and cholinergic activation indexed by skin conductance responses and decrease in heart rate, followed by a stress or relaxation response depending on the presence of threat (Bradley, 2009; Sokolov & Cacioppo, 1997). Although the autonomic profile of REM sleep is more complex than an orienting response, features of REM sleep are momentary cholinergic activation; startle responses; rapid shallow breathing; and temperature increases in the extremities (Stickgold, 2002). Interestingly, both orienting responses and REM sleep involve eye movements (Wright & Ward, 2008). Acknowledging that the type of EMs in orienting responses (visual or smooth pursuit) and REM-sleep (saccadic) may differ, a way of examining orienting response and REM hypotheses of EMDR therapy is to study changes in physiological activity during EMDR desensitization sessions.

Few studies have investigated psychophysiological concomitants during EMDR. Two uncontrolled studies that measured physiological changes throughout EMDR therapy of patients with PTSD found across-session trends of psychophysiological de-arousal, and EMs were associated with increased parasympathetic nervous system activity, that is, decreased heart rate and increased heart rate variability, decreased sympathetic nervous system activity (reflected by decreased skin conductance and increased finger temperature), but also increased respiration rate (Elofsson, von Schéele, Theorell & Söndergaard, 2008; Sack, Lempa, Steinmetz, Lamprecht & Hoffman, 2008). Authors highlighted that some physiological data associated with EMs fit with orienting response theory (i.e., reduced heart rate immediately as EMs began), yet others contradicted (i.e., increased respiration rate and skin temperature). However, these contradictory physiological responses were characteristic of REM-sleep. Thus, the EMs in EMDR may create orienting responses and a REM-like state. However, to attribute any changes to EMDR therapy, or the EMs, a comparison control is needed. Previously Wilson, Silver, Covi, and Foster (1996) recorded physiological changes during EMDR treatment of traumatic memories compared to two other treatments. They reported that heart rate and blood pressure decreased and finger temperature increased during EMDR, but not in control groups. During EMs heart rate decreased, respiration changes were described as matching the EM rhythm and became shallow, and the galvanic skin response increased in the first 5-10 seconds then decreased within the EM set. In a nonclinical sample, where negative autobiographical memories were treated with EMDR-with-EMs, or with a similar procedure but without EMs (Schubert, Lee, & Drummond, 2011), a similar physiological profile was seen: de-arousal across the treatment session; EMs were associated with immediate significant reductions in heart rate; heart rate variability and respiration rate increased across the set; and although skin

conductance decreased across the EMs set, short bursts in skin conductance occurred as EMs began. Skin conductance response number and size were more frequent in the EMDR-with-EM than the EMDR-without-EM condition, and responses habituated within EM sets and across the session, characteristic of an orienting response.

The limited research that has measured physiological activity during EMDR therapy has been conducted in Western treatment settings. Whether the psychophysiological correlates of EMDR therapy might apply cross-culturally, and/or in treatment of PTSD post-war/conflict in a real world setting, has yet to be investigated. Thus, the aim of this study was to examine the psychophysiological correlates of EMDR therapy when used to treat symptoms consistent with PTSD in a real world, post-war/conflict setting in Timor-Leste. Timor-Leste is a half-island country north of Australia that was invaded and occupied by Indonesian military (1975-1999). This period of time was characterized by allegations of extensive human-rights violations, including mass killings, torture, systematic rape, and arbitrary detention. In 1999, a vote for independence was followed by widespread destruction of infrastructure by pro-Indonesian militias and 80% of the East Timorese population was displaced (Modvig et al., 2000). We recently reported that EMDR therapy was successful in treating PTSD symptoms in adults in Timor Leste (Schubert et al., 2016). In the present study it was hypothesized that physiological de-arousal would occur within EMDR treatment sessions in Timor-Leste, and that psychophysiological responses associated with the EMs would be similar to those seen in Western settings: decreased heart rate as EMs began; decreased skin conductance within EM sets; respiration rate increases in EM sets; along with skin conductance responses that habituate in size and number in EM sets characteristic of an orienting response.

Method

This study was designed to examine the psychophysiological correlates of EMDR therapy to treat PTSD symptoms in Timor-Leste. The study was designed so that following an initial 2 hour assessment, which included teaching stabilization techniques, participants served as their own 2 week waitlist control. Subsequently they engaged in EMDR therapy, with posttreatment assessments 2 weeks after the final treatment session, and follow-up at 3 months (Schubert et al., 2016). During the first and last EMDR treatment sessions, where desensitization of traumatic memories took place, physiological activity was recorded. In the assessment participants gave written consent. The Murdoch University Human Research Ethics Committee, Australia, and The Cabinet of Health Research and Development under the Ministry of Health in Timor-Leste approved the research.

Participants and Procedure

Participants were from an EMDR treatment trial (Schubert et al., 2016). In the trial 28 participants were referred primarily through Timorese community development and health non-government organisations (NGOs), Australian People for Health, Education and Development Abroad (APHEDA), and Psychosocial Recovery and Development in East Timor (PRADET). Inclusion criteria were: Timorese, aged 18-65 years, had experienced traumatic events at least 3 months before study entry, reported symptoms consistent with PTSD with a trauma symptom scale score of ≥2 using the Harvard Trauma Questionnaire (HTQ; Mollica et al., 1992). Exclusion criteria were history of eye disease, or blindness. Included were 23 participants (16 female, 69.6%) with a mean age of 30.52 ($SD = 11.29$) years. Excluded participants were 4 who scored < 2 on the HTQ Trauma Symptom Scale, and 1 whose memories of traumatic experiences were not associated with hyperarousal, and symptom presentation was more consistent with depression and anxiety than PTSD. Prior to commencing EMDR treatment, 2 participants dropped out from the wait period, and one dropped out after commencing therapy (see Figure 1. for flow diagram of participants and attrition for this treatment trial).

Thus, for 20 participants EMDR therapy followed Shapiro's (2001) protocol, and included all eight treatment phases: (1) client history and assessment, (2) preparation, (3) target assessment, (4) desensitization, (5) installation of positive cognitions, (6) body scan, (7) closure, and (8) reevaluation. In this study Phases 1-2 occurred in the initial assessment session. Target memories were also identified throughout the assessment. Following an explanation of the research rationale and EMDR procedure, participants were asked which traumatic experience they would like to, or felt most comfortable processing first in treatment. Identification of possible initial target memories occurred in the assessment session to prepare for the first treatment session. This treatment session began with Phase 3, target assessment and also included desensitization (Phase 4). If time allowed the first treatment session also included Phases 5-7. EMDR treatment sessions were 1-1.5 hours long. Individual needs of participants determined the length of treatment.

Therapists and Fidelity

Two therapists provided EMDR therapy. Both were clinical psychologists and accredited EMDR Association of Australia (EMDRAA) consultants. The translator was a local Timorese person with tertiary education and experience in community development and health, but no formal psychology training. Therapists and the translator followed a step-by-step EMDR protocol. When consent was provided treatment sessions were video-recorded. An EMDR International Association (EMDRIA)-approved consultant randomly selected 12 sessions and rated them on a 27 item EMDR fidelity checklist. Items were scored on a 7-point scale (1 = *poor*; 7 = *excellent*), and the average rating for each session was 6.08 ($SD = 0.67$).
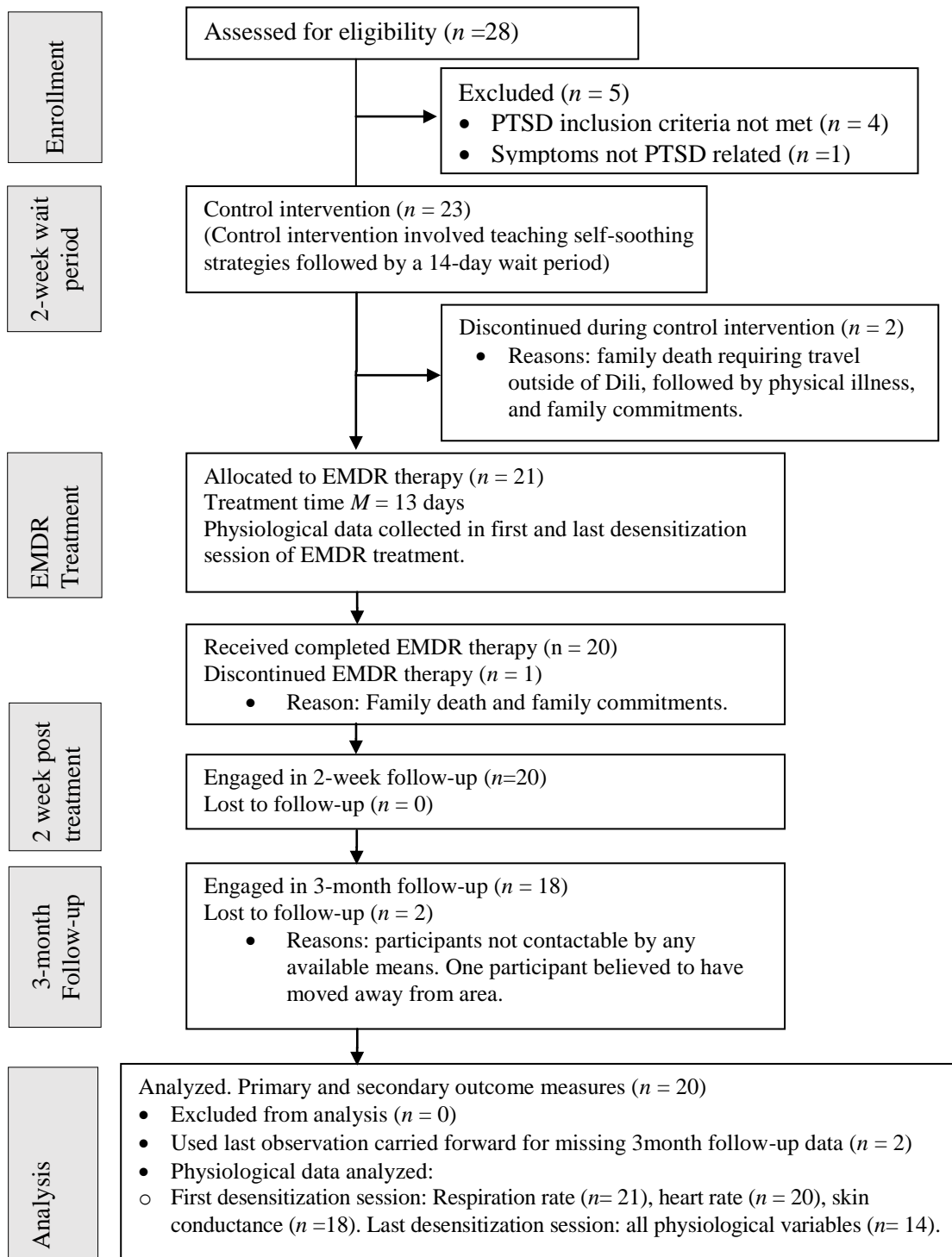
FIGURE 1. Flow diagram for EMDR therapy trial in Timor-Leste. PTSD = posttraumatic stress disorder.

Psychophysiological Assessment

Changes in heart rate, skin conductance, and respiration rate were recorded continuously throughout the first and last sessions where desensitization of traumatic memories took place. These variables were chosen because they could be measured noninvasively, without interference to treatment. At the beginning of the session, following placement of sensors and

electrodes, a 5-minute adaptation period occurred to allow physiological activity to stabilize, then treatment began, and data was acquired during the entire session.

Electrocardiograms were recorded using an ECG100C Electrocardiogram Amplifier (Biopac Systems Inc.). A three-lead configuration was used with Ag-AgCl snap electrodes (8 mm diameter) on the inner aspect of both forearms and the right ankle, secured with disposable 3M Red Dot™ foam tape and sticky gel Ag/AgCL eyelet stud electrodes. Skin conductance was measured using a Biopac Galvanic Skin Response Amplifier GSR100C, and was recorded by means of constant voltage (0.5V, set to a gain of 2 μS per volt) using Ag/AgCl-electrodes (8 mm internal diameter) filled with electrode gel. Electrodes were attached to the second phalanx of the ring and middle fingers on the non-dominant hand. Respiration was measured using a Biopac general purpose transducer amplifier DA100C with a differential pressure transducer (TSD160B). From this, 1.5 mm tubing was Luer-locked to sensor tubing attached to a Biopac RX110 self-inflating pressure pad transducer that was taped and strapped to the chest to record respiration. All sites were cleaned with an alcohol wipe to ensure good electrical contact between electrodes and skin. It was not possible to control ambient temperature or humidity. Signals were sampled 1000 times/second via a Biopac MP100 data acquisition system, and were averaged using Acknowledge software 3.9.0 (Biopac Systems Inc.). Processing of psychophysiological signals is outlined in previous research (Schubert et al., 2011, p. 4).

Data Analysis

To assess psychophysiological changes within sessions the first 30-second period immediately prior to the desensitization phase was compared to the 30-second period following desensitization. Change was also examined by comparing physiological responses during the first 3 and last 3 EM sets of the session. To assess physiological changes during EM stimulation sets, the following measurement periods were defined: (a) 10-second interval prior to stimulation; (b) first 10-second of EM stimulation; (c) middle of stimulation, defined as the difference between the first and last10 s of each set; and (d) last 10-second of stimulation. The therapist, with a hand held event marker, marked all measurement periods, and the start and end of EM sets in physiological files as data acquisition took place.

Some physiological data was missing in the first treatment session as there were difficulties with the power source in Timor-Leste. Due to electrical noise, skin conductance data was unusable for 3 participants, and heart rate was also unusable for 1 participant. For all other participants physiological equipment was powered through a deep cycle battery. Physiological data was available for 14 of the 20 participants who completed therapy in their last desensitization session, as treatment involved only one desensitization session for 5 participants, and physiological activity could not be recorded for one other participant.

Multivariate repeated measures analysis of variances (ANOVAs) that incorporated planned contrasts to examine a priori hypotheses were used to examine significant effects for within-session pre-post physiological changes, and changes during EM stimulation periods in the last session in which desensitization took place. Specifically, hypotheses were: significant decreases in physiological activity pre-post treatment session; significant decrease in heart rate from pre-EM stimulation to the first 10 seconds of EM sets, with this decrease remaining significantly lower than pre-EM across the EM set; significant decreases in skin conductance from pre-EM stimulation to the middle and end of EM sets; significant increase in respiration rate from the beginning to the end of EM sets; and significant increase in number and size of skin conductance responses in the first 10 seconds of EM sets compared to the middle and end of EM sets. Due to missing physiological data for some participants in their first desensitisation session, univariate repeated measures ANOVAs which incorporated planned contrasts were used to examine significant effects in EM stimulation periods, and paired t-tests were used to investigate within session pre-post physiological changes. Huynh-Feldt corrected statistics were reported when the assumption of sphericity was violated. Partial eta squared (η_p^2) was used to report effect sizes for ANOVAs, and Cohen's d for planned contrasts. Being a confirmatory investigation, with analyses conducted on a priori hypotheses, one-tailed planned contrasts are reported. An overall significance level was an alpha level of .05. Data were analysed using IBM SPSS statistics Version 21.

Results

The average number of treatment sessions was 4.14 ($SD = 2.06$, range = 1-10 sessions), over an average of 12.95 ($SD = 8.45$) days. The mean number of traumatic events experienced reported by participants on the HTQ was 7.09 ($SD = 2.31$), and on average 7.35 years (range 3 months to 24 years) had passed since targeted traumatic events occurred.

Psychophysiological Trends within EMDR Desensitization Sessions

In the first treatment session significant decreases were seen in the period from before to after desensitisation of trauma memories for heart and respiration rate (Table 1). In addition, the decrease in skin conductance approached significance, $t(17) = 1.73$, $p = .051$, $d = .28$. For the last session in which trauma memories were desensitized, Pillai's trace indicated a significant overall effect of time on physiological variables, $V = .61$, $F(3,11) = 5.84$, $p = .012$, $\eta_p^2 = .61$. In this session skin conductance decreased significantly. Changes in respiration and heart rate were not significant.

TABLE 1. Means, Standard Deviations, and Changes in Physiological Variables during the 30-Second Rest Period Pre- and Post-Desensitization in the First and Last Treatment Sessions.

Treatment Session	Variable	n	Presession		Postsession		Statistical Comparison	Effect Size[a]
			M	*SD*	*M*	*SD*	*t* (d.f.)	
First	HR (bpm)	20	84.32	13.45	81.46	11.62	2.31 (19)	0.23*
	SC (μS)	18	0.24	0.13	0.20	0.11	-	*ns* [b]
	RR (bpm)	21	23.21	6.02	17.81	7.24	3.33 (20)	0.82**
Last	HR (bpm)	14	83.54	12.06	81.89	12.74	-	*ns*
	SC (μS)	14	0.31	0.11	0.25	0.10	3.90 (13)	0.62***
	RR (bpm)	14	21.96	5.35	20.32	4.89	-	*ns*

Note. HR = Heart rate; bpm = beats per minute; SC = skin conductance, μS = microsiemen; RR = respiration rate; bpm = breaths per minute; *ns* = non-significant.
[a.] Cohen's *d*.
[b.] SC decrease approached significance, $t(17) = 1.73$, $p = .051$, $d = .28$
*$p < .05$. **$p < .01$. ***$p < .001$

Psychophysiological Changes During Eye Movement Stimulation

For the last treatment session in which desensitisation occurred, Pillai's trace indicated a significant effect of time on physiological variables for the first, $V = .839$, $F(9,117) = 5.05$, $p < .001$, $\eta_p^2 = .280$, and last, $V = .772$, $F(9,117) = 4.51$, $p < .001$, $\eta_p^2 = .257$, EM sets of the session. Significant univariate ANOVAs with planned contrasts revealed that heart rate decreased significantly within the first and last EM sets in the first desensitisation session, and within the last EM sets in the last treatment session (Table 2). The decreases in heart rate seen in the first 3 EM sets of the last treatment session approached significance, $F(1.46, 19) = 3.84$, $p = .051$, $d = 228$. Overall, heart rate decreased significantly when EM sets began, and heart rate remained significantly lower than pre-stimulation during the middle and end of EM sets.

Skin conductance also decreased within EM sets, with significant decreases within the first EM sets in the first desensitisation session, and in both the first and last EM sets in the last treatment session where desensitisation of memories took place. Interestingly, skin conductance decreased within EM sets but, unlike heart rate, skin conductance did not decrease significantly within the first 10 secondss of EMs in any measurement period. Overall, respiration rate did not change significantly within EM sets.

The Number and Amplitude of Skin Conductance Responses Within Eye Movement Sets

The number of skin conductance responses per 10 seconds, and the size of these responses were calculated for each measurement period (i.e., the start, middle, and end) in the first and last 3 EM sets of the first and last treatment sessions where desensitisation of memories took place.

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Table 2. Means, Standard Deviations, and Changes in Physiological Activity During EM Stimulation Periods.

Variable	Session	EM sets	n	Pre. A: -13 to -3 s prior to set M (SD)	Start. B: 0-10 s of set M (SD)	Middle. C: between first and last 10 s of set M (SD)	End. D: last 10 s of set M (SD)	Univariate main effect: Time F (d.f.)	P	η_p^2	A/B	A/C	A/D	B/C	B/D	C/D
Heart Rate	First	First 3	20	84.30 (13.38)	82.29 (12.11)	81.41 (12.43)	81.65 (12.28)	7.09 (2.02, 38.30)	.002	.272	.198*	.393***	.362**	.157*		
		Last 3	20	83.84 (13.74)	82.46 (12.54)	81.31 (11.95)	81.99 (11.97)	6.17 (2.41, 45.74)	.003	.245	.220*	.405***	.246*	.163*		.166*
	Last	First 3	14	86.07 (13.88)	82.87 (12.53)	82.59 (12.51)	83.00 (12.42)	3.84 (1.46, 19.00)	.051	.228	.273*	.268*	.213*			
		Last 3	14	85.45 (14.05)	83.09 (12.04)	80.77 (13.57)	80.59 (12.63)	12.68 (3, 39)	.000	.494	.224*	.647***	.678***	.383**	.412**	
Skin Conductance	First	First 3	18	.245 (.162)	.248 (.166)	.241 (.152)	.233 (.145)	4.08 (1.59, 26.97)	.036	.194			.195*		.281**	.353**
		Last 3	18	.219 (.148)	.216 (.144)	.209 (.126)	.205 (.119)	3.83 (1.03, 17.46)	.066	.184		.334*	.193*	.537***	.187*	.237*
	Last	First 3	14	.330 (.125)	.334 (.127)	.317 (.121)	.305 (.117)	15.22 (1.44, 18.66)	.000	.539		.437**	.558***	.507**	.587***	.609***
		Last 3	14	.274 (.128)	.273 (.127)	.266 (.125)	.261 (.122)	10.23 (1.33, 17.33)	.003	.440		.334**	.430**	.001	.544***	.474**
Respiration Rate	First	First 3	21	23.89 (8.56)	22.90 (8.03)	25.04 (9.47)	24.47 (8.83)	1.03 (2, 40)	.367	.049					.149*	
		Last 3	21	21.93 (6.53)	21.05 (6.92)	22.92 (8.49)	22.88 (7.21)	1.70 (3, 60)	.177	.078					.164*	.164*
	Last	First 3	14	23.64 (6.23)	20.07 (3.90)	22.79 (5.58)	23.00 (4.67)	2.82 (1.72, 22.31)	.088	.178	.318*				.479**	.424**
		Last 3	14	21.04 (3.72)	19.91 (3.08)	21.65 (4.61)	21.68 (4.68)	1.12 (1.66, 21.63)	.333	.080					.302*	.230*
Skin Conductance Responses — Number	First	First 3	17	- -	.147 (.275)	.049 (.127)	.058 (.203)	4.18 (2, 32)	.024	.207	-	-	-	.253*	.227*	
	Last	Last 3	13	- -	.205 (.206)	.046 (.092)	.026 (.062)	7.56 (1.27, 15.28)	.011	.386	-	-	-	.380**	.419**	
Skin Conductance Responses — Amplitude	First	First 3	17	- -	.019 (.038)	.012 (.028)	.005 (.018)	1.53 (2, 32)	.231	.087	-	-	-	.177*		
	Last	Last 3	14	- -	.017 (.018)	.004 (.007)	.003 (.006)	6.61 (1.28, 16.59)	.015	.337	-	-	-	.334*	.368**	

Note. EM = eye movement. [a] partial eta squared (η_p^2). *p < .05. **p < .01. ***p < .001

The number of skin conductance responses in each measurement period (start, middle, end) within EM sets indicated a significant effect of time for both the first and last treatment sessions (Table 2). In particular, the number of skin conductance responses decreased significantly from the start (the first 10 seconds) to the middle and end of the EM sets in both the first and last treatment sessions. Overall, findings indicate a reduction in the number of skin conductance responses within EM sets.

The amplitude of the skin conductance responses in each measurement period within EM sets indicated a significant effect of time for the last treatment session, but a non-significant effect of time for the first treatment session (Table 2). In particular, in the last treatment session there was a significant reduction in the size of skin conductance responses from the start compared to the middle and end of the EM sets.

Discussion

This study examined the physiological correlates of EMDR therapy when effectively used to treat adults with PTSD symptoms in Timor-Leste; a post-war/conflict, developing nation. As previously reported, the EMDR treatment was followed by significant reductions in PTSD, depression, and anxiety symptoms (Schubert et al., 2016). Hypotheses regarding psychophysiological changes during EMDR sessions were partly supported, in that: trends and significant decreases in heart rate, respiration rate, and skin conductance indicated physiological de-arousal within treatment sessions; physiological responses associated with the EMs included a significant decrease in heart rate as EMs began; and heart rate and skin conductance decreased within EM sets. In addition, skin conductance responses habituated in number and size within EM sets characteristic of an orienting response. However, although there was a trend for respiration rate to increase in EM sets, the hypotheses that respiration rate would increase significantly during EM sets was not supported.

Psychophysiological Changes From Before to After Desensitization Sessions

In general, physiological data in this study suggested that arousal decreased within EMDR desensitization sessions. Resting levels from before to after the first desensitization session decreased significantly in heart and respiration rate, and skin conductance levels decreased significantly in the last desensitization session. Physiological de-arousal after trauma-focused therapy has previously been reported in Western settings when EMDR therapy (Elofsson et al., 2008; Sack, Lempa, et al., 2008), and therapeutic exposure (Boudewyns & Hyer, 1990) has been used effectively to treat PTSD. Although this real world study had no comparison control, the trends and significant de-arousal seen in Timorese participants supports previous controlled

findings; for example: single EMDR sessions used to treat distressing traumatic memories led to greater pre- to postreductions in heart rate and galvanic skin response compared to two comparison conditions (Wilson et al., 1996); EMDR led to significant reductions in heart rate and skin conductance responses to trauma recall compared to a relaxed state (Aubert-Khalfa, Roques, & Blin, 2008); and decreases in heart rate and increases in heart rate variability indicated increased parasympathetic tone during exposure to script-driven imagery compared to a neutral task after EMDR and at 6 months follow-up for PTSD patients (Sack, Lempa, & Lamprecht, 2007). Changes were also similar to those seen during EMDR treatment of a negative autobiographical memory in a non-clinical population (Schubert et al., 2011).

Psychophysiological Changes During Eye Movement Stimulation

The physiological changes during EM stimulation in this study are consistent with previous research that have demonstrated that EM sets are associated with a pattern of de-arousal, coupled with distinct physiological changes that may aid memory processing (Elofsson et al., 2008; Sack, Lempa et al., 2008; Schubert et al., 2011). In Timorese participants we saw a clear, significant drop in heart rate when EMs began, confirming observations in Western settings with PTSD patients (Elofsson et al., 2008; Sack, Lempa et al., 2008), and in a nonclinical population where EMDR was used to treat negative autobiographical memories (Schubert et al., 2011). The decrease in heart rate as EMs began has been attributed to an orienting response (Sack, Lempa et al., 2008), specific to the EMs in EMDR as the immediate, pronounced heart rate decrease was not present when EMs were removed from the therapy procedure (Schubert et al., 2011).

Our data also indicated that heart rate, along with skin conductance, decreased within EM sets. This decrease in heart rate and skin conductance has been consistently reported in studies of physiological activity during EMDR (Elofsson et al., 2008; Sack, Lempa et al., 2008; Schubert et al., 2011; Wilson et al., 1996). Skin conductance data in this study also mirrors previous reports (Elofsson et al., 2008; Schubert et al., 2011) in that skin conductance decreased significantly only from the middle, rather than start, of EM sets. In principle, if the prominent decrease in heart rate at the start of EM sets is driven by an orienting response then it should be coupled with an immediate startle response indexed by skin conductance responses in the first 10 seconds after EMs begin (Bradley, 2009), which then habituate. This pattern of response was seen in this study as there were significantly more and larger skin conductance responses at the beginning of EM sets than during the middle and end of sets.

In the first physiological examination of EMDR sessions 20 years ago it was reported that "during EMDR, the GSR [galvanic skin response] characteristically rose at the beginning of the set - as the subject focused on a disturbing memory – peaked at 5-10 seconds, then decreased

thereafter" (Wilson et al., 1996, p. 226). Wilson (1996) proposed that this galvanic skin response rise and fall was distinct from an orienting response as in their study they reported that EMs alone, without focusing on a traumatic memory did not produce an increase in galvanic skin response followed by decrease. However, more recently Schubert et al. (2011) found that EMDR-with-EMs produced significantly more skin conductance responses within desensitization sets than EMDR-without-EMs; that the amplitude of the skin conductance responses decreased significantly within EM sets in EMDR-with-EMs compared to EMDR-without-EMs; and that the number of skin conductance responses habituated across the session for EMDR-with-EMs compared to no significant change for the no-EM condition. These findings, combined with the present confirmatory data in Timorese participants, in which skin conductance responses reduced in number and size within EM sets, along with the immediate decrease in heart rate as EMs began, and the decrease in heart rate and skin conductance across EM sets, suggest that EMs in EMDR elicit an orienting response.

The role of an orienting response in EMDR is theoretically important. From an orienting response perspective, physiological changes reflect specific perceptual and motor processes that have evolved to protect the organism from threat (Bradley, 2009). Heightened skin conductance is an index of sympathetic nervous system activation, a defense response supporting behavioral arousal and preparation for action, whereas cardiac deceleration is associated with enhanced perceptual processing, an openness to intake of sensory information (Bradley, 2009). From dismantling laboratory research, the type of EMs utilized in EMDR have been shown to facilitate attentional orienting and with that induce cognitive and semantic flexibility (Kuiken, Bears, Miall, & Smith 2001-2002), and also enhance episodic memory retrieval (Christman et al., 2003). A meta-analysis (Lee & Cuijpers, 2013) that examined the effects of EMs in both laboratory and EMDR treatment studies confirmed that EMs in both settings significantly decreased vividness, and in turn the distress of negative memories (Smeets, Dijs, Pervan, Englehard, & van den Hout, 2012). Neuroimaging research that examined changes in brain activity pre-and post-EMDR treatment (Levin, Lazrove, & van der Kolk, 1999), along with Stickgold (2002; 2008), who first recognized the neurological and physiological pathways linking EMDR to REM functioning, state that EMDR therapy creates neurological states that facilitate memory processing. Although it cannot be simply assumed that EMs in laboratory, dismantling studies create the same neural environment as EMs in EMDR therapy during desensitization of trauma memories, nevertheless in EMDR the EMs, and the associated orienting responses, may be important for attending to and making sense of memories, thoughts, feelings, and bodily sensations that arise during desensitization of traumatic memories. From the treatment studies that have examined the physiological correlates of EMDR therapy (Elofsson et al., 2008; Sack, Lempa et al., 2008; Wilson et al., 1996), it can be stated that the EMs and associated orienting responses induce a form of psychophysiological dearousal that is

incompatible with fear and avoidance, which may make the task of attending to and processing trauma and associated memories more tolerable.

REM hypotheses of EMDR propose that orienting responses, induced by the EMs in therapy, activate brainstem circuits that could initiate a REM-like state (Stickgold, 2002). Previous research has found similarities in physiological changes during the EMs in EMDR compared to the typical autonomic pattern of REM sleep (Elofsson et al., 2008). For example, during EMs in EMDR there was a change in respiration rate manifested by increased frequency and a tendency for participants to become more hypercapnic (increased carbon dioxide) and hypoxemic (decreased levels of oxygen) (Elofsson et al., 2008). This respiratory profile is consistent with REM-sleep. Other researchers have found that the EMs in EMDR are associated with an increase in respiration within EM sets which may suggest similar physiological states during EMDR and REM, as REM-sleep has been associated with fast, shallow breathing (Elofsson et al., 2008; Sack, Lempa et al., 2008; Schubert et al., 2011). In the current study, although there was a trend in the expected direction, the increase in respiration during EMs was not significant. Although this may be due to the small sample size, the measurement of respiration used in Timor-Leste was also different from Elofsson and colleagues (2008) who measured expiratory carbon dioxide levels (via a nasal catheter) and blood pulse oximeter oxygen saturation, with respiration rate computed using recorded carbon dioxide wave data. In the present study respiration was measured using a self-inflating pressure pad transducer around the participant's chest as this was considered non-intrusive to the therapy process. The cost however, was that raw respiratory data was markedly influenced by artefact, and as in previous research (Schubert et al., 2011), respiration rate was determined by manually counting and averaging respiration cycles for each measurement period. Thus, respiration data in this study relied on human judgement. Future research would benefit from replicating the respiration findings within Elofsson et al. (2008) and Sack, Lempa et al. (2008), whose measures did not introduce subjectivity.

Limitations were that this study was a real-life, naturalistic intervention without a separate control condition. One cannot, therefore, rule out that the physiological changes were due to something other than the treatment. Psychophysiological data in this preliminary study need to be interpreted with caution due to the small sample size and variation in the number of participants across measurement periods. Further research to confirm these findings is warranted, utilizing larger sample sizes with active controls, and a wider range of physiological variables. For example, future protocols should also incorporate finger temperature (or a more dynamic measure of vascular tone) to explore whether REM-like mechanisms are involved, and if so to differentiate between the mechanisms of EMs being orienting response and/or REM-related. To examine REM hypotheses of EMDR further it would be interesting to determine whether the startle responses associated with the EMs in EMDR occur in concert with brainstem

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initiated ponto-geniculo-occipital (PGO) waves, as REM sleep is the only state known to generate PGO waves, or rather PGO waves are theorized to signal the beginning of REM-sleep cycle (Hobson, Stickgold, & Pace-Schott, 2000; Stickgold, 2002). In addition to orienting response theory and REM effects, working memory (Maxfield, Melnyk, & Hayman, 2008) and neurological reconsolidation (Levine et al., 1999), along with processes such as reciprocal inhibition (Wolpe, 1991), and psychological distancing (Lee & Drummond, 2008) may contribute to EMDR and require consideration in future research to attain a comprehensive understanding of how EMDR works.

Conclusions

To our knowledge this is the first research that has examined physiological correlates of EMDR therapy when used to treat trauma symptoms in a real world setting, post-war/conflict, developing country. The psychophysiological changes seen in Timorese participants resembled those seen in Western treatment settings and may aid in the refinement of models that attempt to explain the underlying basis of EMDR therapy. As trauma is a global issue, the examination of effective trauma therapy ought to be global and cross-cultural, and evidence should be sought in all contexts and populations as to how the body and brain mechanisms lead to trauma recovery.

Acknowledgements

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Update of research post publication, and reflections on cross-cultural research

Chapters 4 and 5 presented research on the effectiveness and physiological correlates of EMDR when used to treat PTSD symptoms in Timor Leste. Directions for future research were discussed with an emphasis on trauma being a global issue and the need to replicate findings in other cross-cultural settings, contexts, and populations. Post publication of chapters 4 and 5, the first pilot RCT in which EMDR was used to treat PTSD symptoms in a refugee camp setting was published (Acartuk et al., 2015). Participants were 29 adult refugees who had fled war/conflict in Syria and were in a camp at the border between Turkey and Syria. Participants were allocated to EMDR or waitlist control. Results indicated that EMDR was effective at reducing PTSD and depression symptoms, and that EMDR was acceptable and feasible. Prior to this two other RCTs had examined the efficacy of narrative exposure therapy, psychoeducation, and supportive counselling in a refugee camp setting in Uganda (Neuner et al., 2008). Narrative exposure therapy was found to be more effective than the other interventions examined. Two meta-analyses have recently examined trauma-focused therapies to treat trauma in refugee populations (Gwozdziewycz & Mehl-Madrona, 2013; Lambert & Alhassoon, 2015). Gwozdziewycz and Mehl-Madrona (2013) examined only narrative exposure therapy used to treat refugees, included 7 studies, and reported an average effect size (Cohen's $d = 0.63$) of all interventions. Lambert and Alhassoon (2015) examined all available RCTs of trauma-focused interventions for traumatized adult refugees and found a large effect for PTSD (Hedge's $g = .91$) from 12 studies included. Both meta-analyses concluded that trauma-focused therapies can be effectively used to treat trauma symptoms in adult refugees, but the number of studies and sample sizes were small, and only one study examined the effectiveness of EMDR (ter Heide, Mooren, Kleihn, de Jong, & Kleberand, 2011).

The dearth of EMDR research in the context of ongoing man-made violence or conflict, or its direct aftermath post-conflict, was also recently highlighted in a review of psychosocial interventions in humanitarian contexts (de Jong, Knipscheer, Ford, & Kleber, 2014). The studies reviewed (5 RCTs, 4 controlled trials, and 7 non-experimental studies) included participants that primarily had experienced war-related violence. The review highlighted concern for the lack of any research on the effectiveness of EMDR in post war/conflict settings. This disconnection between research and practice reflects an earlier finding of Tol and colleagues (2011) who, in their review of mental health interventions for children, adolescents and adults in humanitarian settings, concluded that the interventions most commonly used (i.e. basic individual, group, and family counselling) have had little rigorous scrutiny. Authors called for collaboration between researchers and practitioners, and new innovative research designs where RCTs are not feasible to begin to reduce the gap between science and practice in humanitarian settings.

Practical and logistical difficulties, lack of culturally sensitive and valid measures, and ethical concerns have undoubtedly impacted research and treatment outcome data being collected in post war/conflict, humanitarian settings, and refugee populations (Slobodin & de Jong, 2014). Research on trauma-focused therapies offered in post-war/conflict humanitarian settings may also be lacking due to the belief that such interventions may be inappropriate, as other community, family, and individual needs should be prioritised, and that therapy in this population, referred to as vulnerable and complex, may be ineffective and even lead to unmanageable distress and/or psychological decompensation (NICE, 2005; Nickerson et al., 2011). There is currently no evidence that indicates those suffering effects of trauma post-war/conflict in unstable settings are unable to benefit from trauma-focused treatment (de Jong, 2014; ter Heide et al., 2011). The most recent RCT that examined EMDR therapy compared its use to stabilisation in a refugee population with PTSD symptoms to specifically examine efficacy and safety (ter Heide et al., 2016). In this study no differences were seen in safety or efficacy between EMDR and stabilisation as usual. The limited efficacy of EMDR in this study was unexpected. Authors proposed that this population may need more than the 6 desensitisation sessions offered, and their population also included asylum seekers as well as refugees, adding to the complexity, instability of daily life, and fear of possible expulsion back to their country of origin with ongoing conflict. Nevertheless, this study was significant as it was the first RCT to demonstrate that targeting traumatic memories in refugees and asylum seekers who have fled war and conflict is safe and carries no harm. Further research is necessaary on the use of EMDR in war/conflict related PTSD in various cultures and contexts.

Assumptions, critiques, and challenges of cross-cultural trauma research

The challenges and critiques posed when planning real world, cross-cultural research can be overwhelming. The importance of aiming for the highest quality scientific evidence is undisputed, but high standards, that may seem impossible in real-world settings, may discourage research in conflict areas. Those planning to work in cross-cultural settings confront many ethical and methodological challenges. Discussions on culturally sensitive methodology are limited and there is relatively little information on how to sensitively overcome challenges. To share lessons learnt with others planning to work cross-culturally a selection of the critiques, assumptions, and challenges that were encountered whilst planning and conducting the research in Timor Leste are presented, along with a response that aimed to address concerns raised.

Table 1.

Assumptions, critiques, and challenges of cross-cultural trauma research, with response.

Assumption, critique	Response
1. The government will not allow trauma research to be conducted in Timor Leste.	The Cabinet of Health Research and Development (CHRD) under the Ministry of Health was established as the first health research institute in Timor-Leste (Martins & Hawkins, 2012). Research is seen as an essential component for developing the countries health system, and evidence-based practice. Permission can be attained.
2. PTSD is a Western construct, and trauma memories and symptoms are normal reactions and should not be labelled as a mental disorder.	PTSD is a Western construct, but PTSD-like symptoms have been described for centuries, and are identified across contexts and cultures (Wilson, 2006). It cannot be assumed, however, that PTSD symptoms can be regularly identified in different social settings, and that they mean the same thing across settings (Summerfield, 1999). Types of traumatic events differ cross-culturally, as does the meaning attributed to events. Events considered traumatic in one culture may not be so regarded in another (Herbert & Foreman, 2010). Culture specific idioms of distress influence individual responses to trauma and how PTSD-like symptoms are expressed. Culture shapes how trauma is interpreted, experienced, expressed, adapted to, and recovered from (deVries, 1996; Wilson, 2006, 2007). Memories of traumatic events that are recalled with appropriate levels of distress and in a coherent, adaptive way are normal. This needs to be distinguished from trauma memories that are intrusive, distressing, vivid, fragmented, and debilitating in that the memory and other associated responses and symptoms continue to impact one's emotional and social wellbeing over time (Stickgold, 2002).
3. Western measures of PTSD do not measure the complexity of the impact of trauma cross-culturally.	This is a core issue in the area of global knowledge and treatment of trauma. The list of core DSM-5 or ICD-10 PTSD symptoms are not comprehensive in covering the many complex and diverse ways in which people typically respond and react to long term, widespread violence, war, and displacement, in a collective culture (Wilson 2006). Other symptoms, such as feeling guilty to have survived, feeling betrayed by trusted ones, self blame, and difficulties fulfilling social roles, are common responses to trauma experiences that are distressing and debilitating post large scale trauma cross-culturally (Mollica et al., 1992, 2004). Posttrauma responses can also include mood, personality, and identity alterations, other anxiety reactions, dissociation, impact developmental processes, and alter belief and value systems, and reduce future resilience (Wilson, 2006). At present there are no standardized universal measurements of trauma and PTSD (Dana, 2000). Any measure used to assess trauma symptoms needs to be recognised not only for what it measures, but for the reactions and impact of trauma it does not capture. Local idioms of distress may often be more salient concerns than those symptoms captured by Western PTSD measures.
4. Western knowledge carries a stamp of authority and offering a Western treatment in a non-Western culture will undermine local systems and pathways to healing.	This is an important issue for any humanitarian program post disaster or war. It cannot be assumed that Western psychotherapies for PTSD are useful in non-Western cultures. Healing and recovery is person- and culture-specific and there are multiple pathways to posttraumatic recovery should they be needed (Wilson, 2006). Cultures have evolved specific rituals, treatments, ceremonies, and social support systems to facilitate recovery from trauma. There are no standardized cross-cultural treatment protocols for persons suffering from posttraumatic syndromes. There are empirical and clinical voids in knowledge as to what treatments work best for what types of person and under what circumstances (Wilson, 2006). More inquiry and evidence is needed to know what traditional and indigenous healing and other therapeutic approaches work best to help people recover from trauma, and in what context, for whom, and how multiple pathways of healing can be integrated together sensitively, effectively, without doing harm.

Table 1.

Assumptions, critiques, and challenges of cross-cultural trauma research, with response.

Assumption, critique	Response
5. Ethical issues around obtaining informed consent are too great.	Informed and voluntary consent is based on Western values of individual autonomy, self-determination, and freedom (Durham, 2014). Thus, obtaining informed consent can be challenging in cross-cultural research, particularly in a collective culture. Ensuring that participants have enough knowledge and understanding about the procedures, consequences of their participation, and potential harm to them is challenging when cultural issues come into play (Liamputtong, 2010). For example, in some cultures it is impolite to refuse or say no, literacy and education levels may be low, and people may be unfamiliar with the culture of scientific research (Durham, 2014). Be as honest as possible about research: its nature, course, funding, and one's role as a researcher. Allow for open two-way conversations about all aspects of the research, and build trust and rapport, which will allow participants to feel more able to withdraw at any time if they wish (Fluehr-Lobban, 1994). Obtain consent in the local language, with an understanding of culture and value systems. If using an interpreter ensure they are trained to fully inform participants of their rights. Obtaining consent is not a process to rush, it is an ongoing process, and it should be obtained at each meeting with a participant. Keep consent forms simple, with appropriate translation (Liamputtong, 2010). Read forms out loud, and consider verbal or video recorded verbal consent, in place of signed written consent.
6. The concept of confidentiality exists globally.	Confidentiality is a Western-based ethical guideline. Differing norms of confidentiality pose a significant challenge when researching and disseminating therapies cross-culturally. In collective cultures social norms do not facilitate maintenance of privacy and confidentiality in communities. An additional dimension in Timor Leste was that during the civil war people betrayed each other and interpersonal trust was eroded. Still today confidentiality as a concept is typically not adhered to in Timorese culture. At times Timorese participants requested to not to have the Timorese translator present due to fears that confidentiality would not be maintained. The presence of a Western therapist in our research may have facilitated a sense of confidentiality.
7. There's not much we can do to treat trauma, PTSD treatments do not work, and there's no evidence for their use cross-culturally.	A large body of research demonstrates that therapeutic and pharmacological treatments can effectively treat PTSD in Western contexts. There is less evidence for the effectiveness of therapies, i.e. EMDR and trauma-focused CBT, cross-culturally. There is evidence that Western therapies can be used effectively cross-culturally (Başoğlu et al., 2005; Neuner et al., 2004; Zang et al., 2013; Konuk et al., 2006). Whether these Western therapies are more effective than traditional pathways to healing, or can be effectively integrated with traditional modes of recovery, is yet to be examined.
8. EMDR (being a Western therapy) cannot be used cross-culturally, with complex clients (they will unravel), in chaotic environments (there will be no science).	There is evidence that EMDR can be effectively applied cross-culturally in chaotic post-disaster settings (Errebo et al., 2008; Jaberghaderi et al., 2004; Jarero et al., 2011; Konuk et al., 2006). There is less evidence for the use of EMDR with complex PTSD (Korn, 2009). Evidence-based trauma therapies, including EMDR, have safety procedures within the treatment protocol, i.e. EMDR includes developing affect tolerance, self-regulation, ensuring readiness for trauma processing, and follow-up. There is evidence that using EMDR to treat refugees with chronic PTSD in unstable conditions carries no harm, no risk of unmanageable distress, or fear of psychological decompensation (Ter Heide et al., 2011; 2016).

More evidence is needed on the use of EMDR cross-culturally with complex PTSD associated with psychotic disorders, substance dependence, and severe suicidal ideation. Real world, cross-cultural research is difficult, and patient care takes priority over science. Research not meeting gold standards of PTSD treatment outcome studies may be difficult to publish. Nevertheless, attaining treatment data, and maintaining high levels of science in real world settings, and disseminating findings from real world cross-cultural setting is still possible. |

Table 1.

Assumptions, critiques, and challenges of cross-cultural trauma research, with response.

Assumption, critique	Response
9. EMDR cannot be used effectively through a translator.	Conducting therapy in participants' mother tongue has been shown to increase efficacy (Griner & Smith, 2006). Interpreters in therapy may impact rapport, alliance and process (e.g., Miller, Martell, Pazdirek, Caruth, & Lopez, 2005). Language is a way in which we organise our world (Liamputtong, 2010). As a researcher, understanding language aids in understanding the culture. To establish rapport and show respect, learn basic phrases, how to address people, and common language used in therapy (i.e. emotions). There are clinical trials of trauma-focused therapy where interpreters have been used with effective treatment reported (e.g., Neuner et al., 2010; Stenmark et al., 2013; Ter Heide, Mooren, Kleijn, DeJongh, & Kleber, 2011), and meta-analysis found no difference in trauma-focused therpy outcomes when interpreters were used to treat PTSD in refugees (Lambert & Alhasoon, 2015). The efficacy of EMDR with interpreters, and the influence of interpreters on treatment, requires attention in future research.
10. Psychophysiological measures cannot be obtained cross-culturally.	Acceptance by the local ethics board and participants of psychophysiological sensors, electrodes, and equipment did not present as an issue. If measures are non-invasive participants habituate to wearing the equipment used to measure physiological activity. Rather issues lay with a mistaken assumption that there would be a stable, constant power supply to run equipment, and a regular clinical setting in which to have equipment permanently set up. Powering and transporting equipment was problematic, i.e. by motorbike, walking, or local taxi. Unstable power creates electrical noise in sensitive equipment and leads to unusable data. Resolving psychophysiological equipment issues without technical support or the capacity to obtain new or substitute equipment was problematic, and at times resulted in loss of data, which in cross-cultural samples, where participant numbers are often small, can lead to lack of statistical power.
11. In large scale trauma, collective needs are more important than the individual, who is more concerned with social, material, and physical needs over mental health.	War and large scale disaster result in destruction and traumatisation at a social as well as an individual level (ter Heide, 2014). Primarily interventions are needed for the collective rather than the individual (Summerfield, 1999). Understandably community and family, as well as medical, physical, social, and practical needs take precedence over psychological needs. Community based programs post-war and disaster that target collective needs can assist large numbers of people. Community based programs, however, may not meet the needs of all individuals. There will be a residual group who will require individual-based care. Individual trauma-focused therapy may benefit those who remain impacted by trauma experiences after physical and practical needs have been met (ter Heide, 2014). Once community needs are being met, and protective factors and social support networks are re-established, there is a space for targeted individual psychological care, ensuring that it complements and does not disrupt existing cultural forms of support (Ager, 1997).

Finally, if challenges and ethical decisions are resolved guided from the principle of respecting the humanity of others as one would have others respect one's own, resolutions will likely be sensitive and appropriate. It is when researchers "do not feel such respect, then no matter how scrupulously they follow the letter of the written codes of professional ethics, or follow the recommended procedures of field [research] manuals, they will betray themselves all along the line in the little things" (Goodenough, 1980, p. 52). Finally, research in Timor Leste was primarily conducted

by a Western outsider, from an individualistic culture, with widely differing social norms and values. As an outsider sensitivity to the culture is not enough when conducting research (Liamputting, 2010). Knowledge of the culture, including historical and political backgrounds, social, familial and religious systems and beliefs, is essential to work effectively with those in the community. Essential skills for research as an outsider include tolerance for ambiguity, adaptiveness, patience, courtesy, flexibility, willingness to learn and listen, and the capacity for genuine empathy for others, who in research in the field of trauma, are trusting you with their stories. As Narayan and George (2002, p. 289) state: "In receiving stories, we are often receiving gifts of self; it is incumbent on us as researchers to handle these gifts with respect as we pass them onward in our scholarly productions". Without trusting participants' willingness to share their stories, trauma research and knowledge would still be in its infancy.

Chapter 6   General discussion

This thesis aimed to examine the efficacy and clarify mechanisms of EMDR therapy when used to treat adult PTSD. Research within this thesis has added to the body of research that has demonstrated that the eye movement component adds to effectiveness of EMDR, and has contributed to theoretical knowledge about how the EMs aid memory processing in therapy. To the best of my knowledge, this is the first research to have examined the effectiveness of EMDR therapy in Timor Leste, a post-war/conflict, cross-cultural, real-world setting. In addition, this is the first research to have examined the physiological correlates of EMDR therapy in a real-world, post-war/conflict setting. Overall, this thesis contributed to the literature on the efficacy and underlying mechanisms of EMDR through the following findings.

Key findings

The literature review in chapter 2 (Schubert & Lee, 2009) summarised 20 years of EMDR research that demonstrated the efficacy of EMDR therapy for the treatment of adult PTSD. The review highlighted the ongoing debate about the necessity and role of the eye movement component in EMDR at that time, and that the exact mechanisms of change underlying EMDR therapy remained unknown. Theories of EMDR that were accumulating empirical support were: orienting response activation, REM-like mechanisms, and working memory accounts.

The research described in chapter 3 examined the efficacy and psychophysiological correlates of EMDR in a study in which non-clinical participants received a single EMDR session either without EMs, or with EMs at either a varied or fixed rate. The findings were that:

- EMDR was effective at reducing the distress and vividness of negative autobiographical memories in a non-clinical population.
- EMDR-with eye movements led to greater reductions in distress and vividness associated with negative autobiographical memories than EMDR with the eye movements removed from the desensitisation procedure.
- There was no significant difference in effectiveness when either fixed or varied rate EMs were used in EMDR. To our knowledge, this was the first research to compare the different types of eye movements in a full standard EMDR desensitisation session.
- A single EMDR session used to treat negative autobiographical memories was associated with dearousal from beginning to end of the treatment session on all physiological variables examined (heart rate, respiration rate, skin conductance, and heart rate variability). The reductions in heart and respiration rate were significantly greater for the EMDR–with eye movement groups than the group who received EMDR-without eye movements.

- During desensitisation the eye movement sets were coupled with distinct psychophysiological changes: heart rate decreased significantly when eye movements began; skin conductance decreased during eye movement sets; heart rate variability and respiration rate increased significantly as eye movements continued; and orienting responses, as indexed by skin conductance responses, were more frequent in the eye movement than no-eye movement condition at the start of exposure. The following physiological changes were found to be distinct correlates of the eye movements in EMDR. Heart rate decreased significantly as eye movement sets began, but did not change at the start of exposure only sets. The significant increase in respiration rate within eye movements sets was not seen in exposure only sets. In contrast, when the EMs were omitted from the procedure respiration rate decreased significantly at the onset of exposure sets, and respiration rate remained significantly lower than the pre-stimulation phase throughout the exposure set. In addition, in EMDR-with eye movements skin conductance decreases were only significant from the middle of eye movement sets, yet decreases in skin conductance were significant within the first 10 seconds of exposure only sets. Overall, the physiological changes in EMDR-with EMs differed from EMDR-with noEMs involving exposure only.
- Orienting responses, as indexed by skin conductance responses that habituated in number and size within eye movement sets, were present in the EMDR-with eye movement condition. Skin conductance responses were, however, also present during EMDR-without eye movements, but the number of responses at the start of treatment was significantly less at the beginning of sets compared to EMDR-with eye movements. In addition, at the start of treatment the size of skin conductance responses decreased significantly within stimulation sets only for the EMDR-with eye movement condition. Findings indicate that different processes underlie EMDR-with eye movements compared with exposure.

Research presented in chapters 4 and 5 examined the effectiveness and physiological correlates of EMDR when used to treat PTSD symptoms in Timor Leste. Findings demonstrated that:

- EMDR therapy, after an average of around 4 sessions over 13 days, was followed by significant and large reductions in PTSD symptoms, depression, and anxiety. Reductions in symptoms were maintained at 3 month follow-up.
- EMDR desensitization was followed by significant decreases in the distress and vividness associated with traumatic memories targeted in sessions. These reductions were also maintained at follow-up. In fact, the vividness associated with targeted memories continued to decrease significantly between treatment finishing and follow-up.
- In a real-world, cross-cultural, clinical setting EMDR desensitisation sessions were associated with dearousal within sessions, and eye movement sets were associated with physiological changes that may aid memory processing: i.e. EM sets were associated with a significant decrease in heart rate as EMs began; heart rate and skin conductance decreased

within EM sets; and skin conductance responses habituated in number and size within EM sets characteristic of an orienting response.

Theoretical models and underlying mechanisms of EMDR

There is still no comprehensive theory that can account for the complex array of biological, psychological, and social responses to experiencing trauma, or the development and recovery of PTSD. Just as there is no one theory of PTSD, or one accepted treatment, EMDR therapy lacks an overarching theory that can explain the mechanisms of change that lead to effective recovery from PTSD. EMDR shares common components to other evidenced-based therapeutic approaches to treat PTSD (i.e. psycho-education, emotional regulation, cognitive restructuring, meaning making, emotions, memory processing), thus it is safe to assume that the treatments will also share some underlying working mechanisms (Schnyder et al., 2015). Unique to EMDR, however, is the eye movements used during desensitisation. Over the past two decades, this element of EMDR has been subject to more scientific research than any other treatment component. In addition, arguably the most important progress has been made in understanding how therapy may work in regards to the physiological and neurological underpinnings of treatment. The role and effects of eye movements, and the biological changes associated with EMDR treatment are currently being examined within three predominant theoretical models of EMDR: that the eye movements tax working memory; elicit an orienting response; and evoke processes that occur during REM-sleep (Solomon & Shapiro, 2008; Shapiro, 2014). In addition, observations have been reported in regards to neurobiological changes following EMDR treatment (see figure 1 for an overview of the proposed theoretical accounts and therapeutic processes underlying EMDR therapy).

Orienting response and REM-sleep hypotheses of EMDR

Examined in this thesis is the hypothesis that the eye movements in EMDR elicit an orienting response (Schubert & Lee, 2009; Schubert, Lee & Drummond, 2011; 2016; Schubert et al., 2016). The orienting response (Pavlov, 1927; Sokolov, 1963) is a natural, innate response to new stimuli in the environment, which is assessed for threat and reflects an increase in physical arousal if a threat is present as a defence response is required. However, after an initial startle and freeze response (reflected in a skin conductance response and an arrest in breathing, respectively), if the stimulus remains but is assessed as nonthreatening dearousal occurs (i.e. cardiac deceleration, skin conductance decreases) (Bradley, 2009). Two decades ago it was proposed that therapist's hand movements in EMDR were a stimulus that elicits an orienting response (Armstrong & Vaughn, 1996). Physiological examination of the EMs in EMDR demonstrated in nonrandomised (Elofsson et al., 2008; Sack et al., 2008) and randomised (Barrowcliff et al., 2003; 2004; Wilson et al., 1995) studies that EMDR-with EMs was associated with dearousal within sessions, and that EMs themselves were associated with
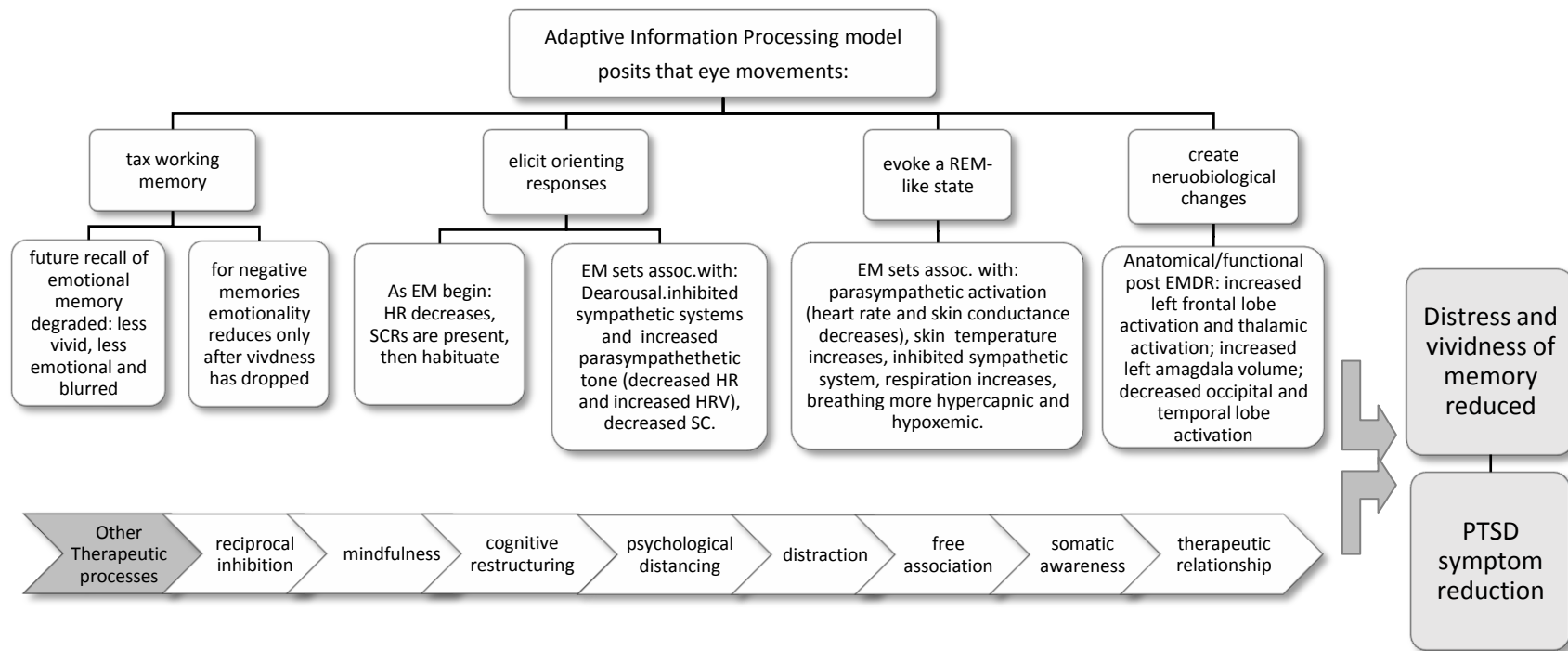
Figure 1. Theoretical accounts of EMDR consistent with research findings, and therapeutic processes underlying treatment.

psychophysiological dearousal within desensitisation sets. The physiological profile of EMDR-with EMs has, however, been a consistently unique response, as dearousal in eye movement sets has been coupled with some physical changes generally associated with arousal, i.e. increased respiration (Sack et al., 2008), or fast and shallow breathing (Wilson et al., 1996), and a tendency for respiration to become more hypercapnic (increased carbon dioxide) and hypoxemic (decreased oxygen) (Elofsson et al., 2008). If eye movements do elicit an orienting response breathing should decrease, following the initial startle and freeze response. This physiological change, along with inhibited sympathetic systems (Elofsson et al., 2008) associated with EM sets in EMDR are, however, similar to the physiological profile of REM-sleep. REM-sleep periods are also easily identifiable by bursts of eye movements.

REM-like mechanisms have been proposed to be activated in EMDR through constant reorienting of attention required by the eye movement task (Stickgold, 2002). A primary function of REM-sleep is the consolidation of memories, and REM-sleep is disrupted as a result of experiences that are over-whelming to process. Research has demonstrated that REM-sleep deprivation has detrimental effects on learning, concentration, and memory consolidation (Dang-Vu et al., 2006). The activation of a REM-like state, while awake, is hypothesised to facilitate integration of trauma memories into general semantic networks. It has been suggested that "rhythmic multi-saccadic eye movements represent the brain's automatic inhibitory (or excitation releasing mechanism) and just as unconscious material surfacing during dreaming is partially desensitized by rapid eye movements (REM), it may be possible that anxiety and rapid eye movements are reciprocally inhibitory" (Bergmann, 2010, p. 25).

In this thesis examination of physiological data collected during EMDR sessions offers support to both orienting response and REM hypotheses of EMDR. In chapters 3 (Schubert et al., 2011) and 5 (Schubert, Lee & Drummond, 2016) EMs in a non-clinical and clinical population were associated with distinct changes: heart rate decreased significantly when EMs began; skin conductance decreased during EM sets; heart rate variability and respiration rate increased significantly as EMs continued; and orienting responses, indexed by skin conductance responses, habituated within EM sets. In chapter 3 it was demonstrated that the significant decrease in heart rate as EMs began and increased respiration within sets were specifically associated with EMs as these changes were not seen when EMs were removed, and participants engaged in exposure only during desensitisation sets. These two changes were hypothesised to be concomitants of an orienting response and a REM-like state, respectively. To our knowledge, the research in chapter 3 (Schubert et al., 2011) is the only study since Wilson and colleagues (1996), to have examined the physiological correlates of an EMDR session that has included a without EM control.

Although orienting response theory is one of the earliest theories of EMDR (Armstrong & Vaughn, 1996; MacCulloch & Feldman, 1996), physiological examinations of EMDR sessions with analysis driven by orienting response theory is rare. Across EMDR research there are some differences regarding the underlying physiological profile of the orienting response. Different conceptualisations of the physiological profile, and the timing in which certain reflexes within the orienting response occurs (i.e. the startle and freeze response), has led to different analyses and interpretation of physiological data in EMDR research. For example, like in our data (Schubert et al., 2011; 2016) Wilson et al. (1996) and Elofsson et al. (2008) reported decreased skin conductance associated with EM sets. Authors differ however, in their interpretation of this finding. Elofsson and colleagues (2008, p. 8), who reference the work of Öhman, Hamm, and Hugdahl (2000), described the orienting response as sympathetic in nature and stated that "the skin conductance response typically increases with the orienting response". Thus, concluded that descreased skin conductance in EM sets was inconsistent with an orienting response. Our understanding is that an orienting response is characterised by an increase in skin conductance (a startle response, i.e. evoked by EMs in EMDR) that habituates quickly, within 5-10 seconds, if the stimulus that evoked the response is determined to be nonthreatening (Bradley. 2009), then a relaxation response occurs (i.e.reflected by decreased skin conductance within EM sets).

To our knowledge the research in chapters 3 and 5 was the first to analyse skin conductance data specifically for the presence (number and size) of skin conductance responses within EM sets; the beginning, middle, and end of sets. Previous research (Elofsson et al., 2008; Wilson et al., 1996) has not examined the presence of skin conductance responses in the 10 second period after EMs began. Rather, what was reported was the mean skin conductance data for this period, which was no different from the measurement period prior to EMs beginning. If skin conductance responses did occur in the 10 seconds after EMs began, skin conductance data would rise and fall, resulting in the average skin conductance data not necessarily changing in this period. In previous research the no change in mean skin conductance data immediately after EMs began, and then a decline across EM sets, may be interpreted as being consistent, rather than inconsistent with orienting response theory. Where our physiological data becomes inconsistent with previous physiological findings sessions (Elofsson et al., 2008; Sack et a., 2008; Wilson et al., 1996) is that in chapter 5 (Schubert, Lee & Drummond, 2016), for participants in Timor Leste, no significant change in respiration rate was seen within EM sets. Previous research has consistently shown an increase in respiration rate during EMDR EM sets, reflecting a possible REM-like state. The respiration rate in our data does not contradict REM hypotheses as trends were in the expected direction; but as discussed in chapter 5, differences in recording equipment and method, analysis of data, and small sample size could account for our non-significant finding. Despite this inconsistency the rest of the data demonstrated that some physiological processes underlying effective EMDR therapy may be the same across cultures. Future research in other real-world settings and cultures is required to replicate these findings and clarify hypothesised treatment mechanisms.

Future examinations of the physiological changes that occur in EMDR therapy should in the design clarify the physiological profile of the orienting response that may occur in EMDR sessions. For example, consider an orienting response with a possible startle and freeze response, prior to a relaxation response, and align the timing of measurement periods with this understanding. Standardizing timing of measurement periods, physiological variables measured, and analysis of data across research would also overcome some differences in interpretation and facilitate advances in this field of inquiry. Because it is plausible that orienting responses and a REM-like state may be present during desensitisation of trauma memories, future research should include physiological variables that can differentiate these physiological states. Although physiological examinations of EMDR therapy have not produced findings that refute the REM hypothesis, it has been highlighted by Bergmann (2010) that there has also not yet been any research that has directly substantiated this model.

Stickgold's (2002) model that proposed that orienting responses may induce a neurobiological state similar to REM-sleep was the first to bring together information processing theory and possible neuobiological and physiological explanations as to how EMDR may facilitate recovery from PTSD. To date, consistent findings in neuroimaging studies of EMDR that have examined PTSD patients pre- and post-EMDR has demonstrated increased left frontal lobe activation (Lansing et al., 2005; Levin et al., 1999; Oh & Choi, 2007), decreased temporal lobe activation (Oh & Choi, 2007; Pagani, 2007), decreased occipital activation (Lansing et al., 2005; Pagani, 2007), an an increase in left amygdale volume (Laugharne et al., in press). Recently Bossini and colleagues (2007; 2011) have reported structural hippocampal growth following EMDR therapy. Also, for the first time an examination of a single EMDR session using auditory stimulation was conducted whilst using fMRI of brain activations at time points throughout the session. The start of auditory stimulation was associated with right ventromedial prefrontal activation (Richardson et al., 2009), and thalamic activation increased following successful EMDR treatment (Richardson et al., 2009). The authors state that these changes suggest the repair of failed information processing that otherwise may have led to spontaneous natural healing from trauma experience. Both neurological and physiological theoretical accounts of EMDR indicate changes that occur in EMDR facilitate the brain's natural information processing system and aid memory processing. Bergmann (2010) has presented a thorough review of physiological and neurological findings relating to EMDR and speculates about how possible mechanisms may work together and resolve clinical PTSD symptoms. For example, increased frontal lobe activation may aid emotional regulation, reduced temporal lobe activity may reflect reduced intrusions and over-consolidation of traumatic memories in episodic form, and decreased occipital activation may lead to fewer occipitally mediated flashbacks. Future research has yet to clarify how possible physiological and neurological mechanisms of change relate to PTSD symptom reduction.

In this thesis the physical dearousal seen within EM sets in EMDR (Schubert et al., 2011; Schubert, Lee & Drummond, 2016) does offer support for an account of EMDR that has proposed counter-conditioning through reciprocal inhibition as a mechanism underlying treatment (Dyke, 1993; Söndergaard & Elofsson, 2008; Wilson et al., 1996). In EMDR the EMs may evoke orienting responses that habituate, resulting in physiological dearousal during sets of trauma memory processing. The theory of reciprocal inhibition states that two incongruent responses (relaxation and anxiety) cannot coexist (Wolpe, 1991). Pairing dearousal, or a relaxation response, with exposure to traumatic memories associated with distress, weakens the distress. A physically relaxed state induced during EM sets may lead to less avoidance of the traumatic memory processing, and may allow for greater ability to sit with and tolerate the stress and discomfort of trauma memory processing.

Working memory account of EMDR

Explanations of treatment effects based on working memory theory assume that eye movements, or other dual-attention tasks used in EMDR, tax working memory capacity through requiring the simultaneous focus on the eye movements and the negative memory targeted in treatment (Schubert & Lee, 2009). Working memory theory is based on Baddeley's (1986) model which states that each component of working memory (i.e. the visual-spatial sketch pad, the phonological loop, and the central executive) has limited memory resource capacity. In EMDR it is hypothesised that negative memories targeted in treatment are held primarily in the visual-spatial sketch pad. Engaging in two things simultaneously (eye movements and thinking of a negative memory) that tax the same component of working memory results in competition for limited resources, and overloads working memory capacity. As a result performance on the primary task declines, and the quality of the targeted memory deteriorates (i.e. becomes less vivid, blurred, and less emotional). It has been proposed that the memory is then reconsolidated in this way (van den Hout & Engelhard, 2012; van den Hout et al., 2013; 2014).

Although this working memory theory of EMDR was not specifically examined in this thesis, some of our findings support this theory. In chapter 3 (Schubert, Lee & Drummond, 2011) and chapter 4 (Schubert et al., 2016) EMDR-with eye movements reduced the distress and vividness of negative autobiographical memories in a non-clinical population, and traumatic memories in a clinical population. In the non-clinical study (Schubert et al., 2011) EMDR-with eye movements led to greater reductions in distress and vividness associated with negative autobiographical memories than EMDR-with the eye movements removed from the procedure. It could be hypothesised that the reductions in distress and vividness were in part due to the eye movements taxing the visuospatial sketch pad component of working memory, compared to EMDR with exposure only, and no dual-attention task being used. In this study, however, our findings raise questions because it was hypothesised that varied EMs would be a more taxing

task than EMs of a fixed speed, and thus EMDR-with varied EMs would lead to greater reductions in distress and vividness of memories compared to EMDR-with fixed EMs. This was not found. The two EM conditions reduced vividness and distress by the same amount. To our knowledge, this was the first research to compare the different types of eye movements in a full standard EMDR desensitisation session; thus, findings require replication.

Although the working memory theory of EMDR has substantial empirical support in that randomised studies have found eye movements reduce vividness and emotionality of negative autobiographical memories (Barrowcliffe et al., 2003; 2004; Englehard et al., 2010; 2011; Gunter & Bodner, 2008; Kavanagh et a;., 2011; Maxfield et al., 2008; van den Hout et al., 2001; 2011) compared to other tasks, more research is needed to examine the comparative effects of different types of eye movements tasks (i.e. fixed or varied rate, fast or slow), and other non-visual, more passive tasks used in EMDR (i.e. auditory tones, tapping, hand held vibrations). Research has yet to determine how much the dual-attention tasks used in EMDR actually tax working memory capacity, or interfere with the visuo-spatial, phonological, or central executive subsystems, if at all. The comparative effects of different dual-attention tasks, eye movements compared to tones, has been examined in a therapeutic context within one EMDR session with PTSD patients (de Jong et al., 2013; van den Hout et al., 2012). Eye movement were found to have better effects than tones, and also significantly greater effects than recall only (no-eye movements), at reducing the distress and vividness of negative memories. There has, however, yet to be a clinical dismantling treatment study with PTSD diagnosed participants that directly compares EMDR-with EMs to EMDR-without EMs, and to EMDR-with other tasks commonly used (i.e. tapping, hand held vibrations). Also the relationship between the effects of different dual-attention tasks used in EMDR and how they relate to treatment outcome needs to be studied. The exact mechanisms by which memories become less vivid and less emotional, and how this translates in to symptomatic improvement from PTSD also remains unknown.

The above theories of EMDR rest mainly on explanations of the effects of the eye movements in EMDR. EMDR is, however, an 8 phase therapeutic approach. Therapeutic elements in the protocol are similar to elements in other evidence-based trauma treatments (Schnyder et al., 2015), and involve possible mechanisms of change through processes of psychological distancing (Lee & Drummond, 2008), distraction, mindfulness, free association, cognitive restructuring, somatic awareness, and the therapeutic relationship itself (Solomon & Shaprio, 2008) (see figure 1). Knowing how a therapy works unquestionably impacts how different elements of treatment can be flexibly applied to each individual (Sexton, Hanes, & Kinser, 2009). Determining the specific working mechanisms of any therapy, however, and how they interact and translate to clinical symptom change is a complex task. It involves examination at the level of the mind, body, and behaviour, analysis of numerous components of treatment that evoke change (i.e. exposure, bilateral stimulation), and investigation of the underlying correlates

of treatment in areas such as physiology, stress- and memory-related systems, endocrinology, brain anatomy, function, and circuitry, and neurochemistry.

Translating science into clinical practice

Theories about how a treatment works influence how the procedure is applied. However, translating scientific research findings into relevant clinical decision making is complex because science does not always fit neatly into practice (Sexton, Hanes, & Kinser, 2009). This thesis evolved from scientific and clinical questions as to how EMDR works. Research findings can guide clinical practice in the following ways:

- EMDR can be used effectively to treat small "t" and big "T" traumas.
- Eye movements in EMDR matter, but research has yet to determine what type of EMs work best, and how their effectiveness compares to other tasks used in clinical practice.
- When processing trauma through desensitisation physiological dearousal is important.
- Trauma is a global issue, and although there is a gap between science and practice of using EMDR therapy to treat PTSD in cross-cultural humanitarian settings, EMDR was demonstrated to be an effective approach in postwar/conflict Timor Leste.

In this thesis PTSD symptoms reduced following EMDR treatment that processed negative and traumatic events underlying PTSD symptoms (Schubert, Lee, Aroujo et al., 2016). EMDR also effectively reduced the distress and vividness of negative autobiographical memories (Schubert et al., 2011) of life experiences that could be defined as small "t" traumas. Although EMDR is considered efficacious only for PTSD treatment, research has shown that is effective for the treatment of small "t" traumas (Cvetek et al., 2008), and treating those suffering the effects of trauma that does not meet the DSM definition of a traumatic event (Wilson, Becker & Tinker, 1995; 1997). Small "t" traumas, particularly, if they are reoccurring, insidious experiences over time (i.e. parental criticism, bullying, childhood neglect, addiction or mental illness in the family, experiences of shame and humiliation), can be just as damaging to quality of life, emotional wellbeing, and social functioning, as big "T" traumas (i.e. sexual abuse, extreme injury, witnessing violence, natural disasters). In fact, research (Mol et al., 2005) has shown that life events (i.e. work and relationship issues, chronic health issues), that are seen as small "t" traumas, can lead to at least as many PTSD symptoms as DSM defined traumatic events. Thus, impact from the experience of big "T" and small "t" traumas deserve equal attention in clinical practice, and both can be effectively processed using EMDR therapy.

According to the AIP model (Shapiro & Maxfield, 2002; Shapiro, 2001), unprocessed adverse life experiences, both small "t" and big "T" trauma experiences, can be the basis of a wide variety of clinical symptoms and presentations. For example, memories of loss can underlie depression, memories of shameful or humiliating social experiences can underlie social phobia,

memories of frightening experiences with animals can underlie a specific animal phobia. Processing autobiographical memories of distressing life events can lead to EMDR being used effectively for the treatment of many psychological (i.e. depression, obsessive compulsive disorder, panic disorder) and medical conditions (Hase et al., 2015; Hoffman et al., 2014; Marr, 2012; Shapiro, 2014).

This thesis (Schubert et al., 2011) has added to the evidence that has demonstrated that in EMDR the eye movements add to the beneficial treatment effects (Lee & Cujipers, 2014). It is, however, widely accepted to replace the EMs with other tasks such as tones and tapping (Kaye, 2007; van den Hout et al., 2012). The replacement of EMs with other tasks is not based on treatment effectiveness research evidence, and the underlying mechanisms of tasks other than EMs remains largely unknown. Until such research is conducted it should not be a clinical assumption that other tasks are as effective as EMs. Eye movements is an active task that demands effortful divided attention to track a moving target while concurrently noticing memories or associated thoughts, feelings, or body sensations (Kaye, 2007). Eye movements are different from other commonly used tasks which impact the brain passively, and it would be safe to assume that they would lead to different impacts on memory, physiology, and neurobiological processes.

The physiological dearousal associated with EMDR desensitisation sessions and with the eye movements during desensitisation sets are clinically meaningful. For some clients the issue may not be the experience or the memory of the traumatic event, but rather the inability to make sense of and feel safe and in control of ongoing intense physiological responses to reminders (Porges, 2001). For some, the consequence of traumatic experiences on their physiology and nervous system is what first-and-foremost impacts their ability to functionally adapt after the event (Levine & Frederick, 1997; Porges, 2001). Sensory triggers of past trauma events activate the limbic system, the emotional brain, to engage in defensive responses resulting in changes in sympathetic and parasympatietic activation, and these changes interfere with executive function and memory processing (van derKolk,2006). Central to any trauma treatment is the ability to self-soothe, to calm and regulate autonomic arousal (Schnyder et al., 2015), and to feel safe in one's ability to engage in trauma-focused work that may need to be done. On the importance of calming the nervous system in trauma treatment van der Kolk (2013, p.520) has recently stated:

> I have been surprised that something that is so obvious to me is not central in our pursuit of effective treatments: learning to regulate your autonomic arousal system is maybe the single most important prerequisite to dealing with PTSD. Physiological arousal needs to be calmed down before you can even access your executive functioning and the rational part of the brain. How people develop treatment techniques that are based on the premise that you can bypass this issue, and ignore what is going on in the basement, beats me.

Within the EMDR procedure the physiological dearousal in EM sets may be calming the nervous system enough to allow effective information processing to take place.

Although there is a gap between the science and practice of using EMDR therapy to treat PTSD in cross-cultural humanitarian settings, in this thesis EMDR was demonstrated as an effective approach to treat PTSD symptoms in postwar/conflict Timor Leste (Schubert, Lee, Araujo et al., 2016). Being the first study to examine EMDR in Timor Leste, and the first to examine the underlying mechanisms of EMDR in a real world, cross-cultural, postwar/conflict setting, findings require replication in other cultures, contexts, and settings. Future research needs to examine the feasibility, applicability, and through qualitative methods examine the cultural appropriateness of treatment, and how it can be used sensitively in combination with other traditional pathways to healing. Also, how effective and culturally appropriate EMDR therapy is compared to other effective treatments, such as narrative exposure therapy (Gwozdziewycz & Mehl-Madrona, 2013) or compared to the effectiveness of local psychosocial interventions for trauma in Timor Leste has yet to be examined.

Trauma is a global issue (Schnyder, 2013), however, in most countries only a small minority of people with mental health disorders receive treatment, and even fewer receive high-quality care (Kessler, 2009). Treatment for trauma, and all issues mental health related, should be available to all; not only for well-off individuals fortunate enough to be living in developed countries (Shapiro, 2014). But what therapeutic intervention works for whom, under what conditions, in response to different types of traumatic events, in the context of individual versus collective practices, and other religious and spiritual healing practices remains unknown (Wilson, 2006). It cannot be assumed, however, that just because EMDR may be demonstrated to be effective in other cultures and contexts, that the mechanisms of change underlying treatment are the same. A global collaborative interdisciplinary, multiprofessional, biopsychosocial approach will be required to advance and refine our understanding of trauma, its development, recovery, and mechanisms underlying effective treatment.

Final Thoughts

Although research clearly demonstrates the efficacy of EMDR for treating PTSD, evidence of effectiveness has been clouded by the lack of understanding of mechanisms. This thesis has demonstrated that eye movements in EMDR matter and that they are associated with distinct physiological changes that aid memory processing. Information processing theories, along with physiological, neurological, and working memory theories of EMDR currently offer plausible explanations as to how EMDR works to treat memories underlying clinical presentations, specifically PTSD. This thesis also suggests that EMDR is effective when used cross-culturally, in real world, post war/conflict settings to treat PTSD symptoms. Each step closer to understanding mechanisms underlying EMDR therapy is also a step closer to understanding the nature of human suffering.

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Appendix A. Omissions and errors in the Institute of Medicine's report on scientific evidence of treatment for posttraumatic stress disorder.

Lee, C.W. and Schubert, S.J (2009). Omissions and errors in the Institute of Medicine's report on scientific evidence of treatment for posttraumatic stress disorder. Journal of EMDR Practice and Research, 3, 32-38. doi: 10.1891/1933-3196.3.1.32

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Omissions and Errors in the Institute of Medicine's Report on Scientific Evidence of Treatment for Posttraumatic Stress Disorder

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Abstract

A recently released report by the Institute of Medicine (IOM, 2008) commissioned by the US Department of Veterans Affairs examined the evidence for psychotherapeutic and pharmacological treatments for posttraumatic stress disorder (PTSD). It concluded that the evidence was inadequate to determine the efficacy of eye movement desensitization and reprocessing (EMDR) in the treatment of PTSD. However, a critical examination of the basis for this conclusion reveals errors in three areas. First, the findings of key studies that reported positive outcomes for EMDR were misrepresented; second, a number of positive studies were excluded without apparent justification; and, finally, the IOM report failed to consider additional readily available studies that also reported benefits for EMDR. These factors appear to explain why the conclusions of the IOM report are at odds with the numerous meta-analyses and practice guidelines of PTSD treatments issued by other scientific committees worldwide.

Keywords: Institute of Medicine (IOM); posttraumatic stress disorder (PTSD); EMDR; evidence based

The Institute of Medicine (IOM, 2008) report commissioned by the US Department of Veterans Affairs to assess the scientific evidence on pharmacological and psychotherapeutic treatment modalities for posttraumatic stress disorder (PTSD) stated that the evidence is sufficient to conclude the efficacy of exposure therapies in the treatment of PTSD. This conclusion is consistent with findings reported in other meta-analyses of psychological treatments for PTSD (i.e., Bisson et al., 2007; van Etten & Taylor, 1998). With respect to pharmacological interventions, the IOM report concluded that the evidence is inadequate to determine the efficacy in the treatment of PTSD for any form of pharmacotherapy. Although this finding is not consistent with the existing divided body of research regarding the efficacy of selective serotonin reuptake inhibitors (SSRIs), the IOM report allowed for an alternate conclusion regarding the efficacy of SSRIs to be offered by a committee member who did not concur with the committee's conclusions. The report also acknowledged other evidence- based assessments, such as the Cochrane systematic review (Stein, Ipser, & Seedat, 2006) and the Australian guidelines for the treatment of PTSD (Australian Centre for Posttraumatic Mental Health, 2007), both of which support the efficacy of SSRIs for PTSD. It is a concern, however, that the IOM committee concluded that "the evidence is inadequate to determine the efficacy of EMDR in the treatment of PTSD" (p. 112) yet offered no sufficient explanation for this finding that is distinctly at odds with the current scientific body of evidence that supports the efficacy of EMDR in treating PTSD (Bisson et al., 2007; Bradley, Greene, Russ, Dutra, & Westen, 2005; Davidson & Parker, 2001; van Etten & Taylor, 1998).

It is understood that in the IOM report, the term "inadequate evidence" is used to designate evidence, judged by the report authors to come "from seriously flawed studies," that the committee is "not confident in the presence of an effect" and that they believe that there is "uncertainty whether future high-quality studies will show an effect" (p. 45). Although the IOM committee examined a number of meta-analyses, the IOM's conclusion regarding the inadequacy of evidence for EMDR is at odds with the most recent meta-analysis of treatments studies for PTSD (Bisson et al., 2007). The committee failed to mention the findings of this meta- analysis in its report. Bisson and colleagues reported that the data from the 38 randomized controlled trials of psychological treatments for PTSD that met predetermined methodological quality inclusion criteria were consistent with conclusions that EMDR- and exposure- based therapies were the most effective treatments for PTSD. This meta-analysis presented evidence that each of these treatments was superior to stress management and other therapies. Three previous meta-analyses of PTSD treatment, mentioned in the IOM report, re- ported similar results. Two of these compared various psychological treatments with each other and found EMDR to be clearly effective and equivalent to traditional exposure-based therapies (Bradley et al., 2005; Davidson & Parker, 2001). Finally, in a meta-analysis that compared psychological treatments and medications, EMDR, traditional exposure therapy, and SSRIs were found to produce the greatest effect sizes (van Etten & Taylor, 1998). However, EMDR and tradi- tional

exposure therapy were found to have an advan- tage over SSRI medication in that dropout rates were lower (14% vs. 32%), and they were more effective in reducing symptoms. Finally, EMDR was considered more efficient than traditional exposure given that the average improvement in the studies using EMDR oc- curred with fewer sessions than the studies using traditional exposure.

The conclusion in the IOM report is also in distinct contrast to the recent acknowledgment by the Australian Centre for Post Traumatic Mental Health (2007) that EMDR is an evidence-based treatment for PTSD. EMDR has also been recognized as evidence-based trauma therapy by the United Kingdom Department of Health, National Institute for Clinical Excellence (2005); in the United States by the American Psychiat- ric Association (2004); and in the Netherlands by the Dutch National Steering Committee for Guidelines for Mental Health Care (2003). In Israel, the Israeli National Council of Mental Health (Bleich, Kolter, Kutz, & Shalev, 2002) designated EMDR as one of the preferred trauma treatments for terrorist victims. In the most recent systematic review of EMDR (Bis- son & Andrew, 2007), published by Cochrane, it was concluded that EMDR, along with trauma-focused cognitive-behavioral therapy, continues to have the best evidence for efficacy and should be considered and made available to individuals with PTSD.

In regard to the body of scientific literature on EMDR, it must be acknowledged that findings are often complex and confusing, and data can be difficult to interpret (Perkins & Rouanzoin, 2002). It must also be recognized that it is possible for committees reviewing evidence-based practice to come to different conclusions when focusing on identical studies even without making any errors. This can occur because reviewers may set different criteria as to the standards required for a study to be included in its deliberations. The IOM committee acknowledged that they had different requirements for a study to be included for consideration of evidence compared to other committees, and these requirements were very clearly detailed. However, this does not appear to account for the gap between the IOM conclusions and other scientific bodies. The reason for the disparate finding regarding the effectiveness of EMDR appears to be not the inclusion and exclusion criteria of the studies themselves but rather the way the studies were inter- preted and because of inconsistent use of the criteria. We found three major flaws:

4. The report misrepresented the findings of cited studies (Carlson, Chemtob, Rusnak, Hedlund, & Muraoka, 1998; van der Kolk et al., 2007; Vaughan et al., 1994), resulting in a failure to acknowledge positive outcomes for EMDR.
5. The committee considered but excluded, without apparent justification, a number of studies (Lee, Gavriel, Drummond, & Greenwald, 2002; Marcus, Marquis, & Sakai, 1997; Rogers et

al., 1999; Roth- baum, 1997; Wilson, Becker, & Tinkler, 1995, 1997) that found positive EMDR treatment effects.

6. The committee failed to consider additional read- ily available studies that also reported benefits for EMDR (Edmond, Rubin, & Wambach, 1999; Iron- son, Freund, Strauss, & Williams, 2002).

The details of these flaws are described next.

Misrepresented Findings and the Failure to Acknowledge Positive Outcomes for EMDR

In the summary of evidence for EMDR, the IOM re- port described Carlson et al. (1998) as one of four studies that had no major limitations. However, the report failed to acknowledge crucial positive findings from this study that supported EMDR by inaccurately stating that the study "showed no effect posttreatment" (p. 99). In fact, significant treatment effects in the EMDR condition were obtained at posttreatment and follow-up on several measures (Carlson et al., 1998). For example, on the measure of PTSD symptoms, the Mississippi Scale, statistical comparisons showed that at posttreatment the EMDR group had significantly lower scores relative to the control group, $t(32) = 2.36$, $p < .05$, $d = 1.01$. In addition, the scores were lower both at posttreatment and follow-up relative to the comparison treatment group, $t(32) = 2.55$, $p < .05$, $d = 1.07$, and $t(16) = 2.15$, $p < .05$; $d = 1.01$, respectively.

Participants receiving EMDR also improved on measures of depression, the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), and anxiety, the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1970). For example, the mean score on the BDI pretreatment was 20.3 but decreased to 6.9 posttreatment. Similarly, mean scores on the STAI improved from 54.0 pre- treatment to 38.6 posttreatment. At posttreatment, BDI scores for the EMDR group were significantly lower than the control group, and STAI scores were significantly lower than both the comparison and the control group. While the IOM report did mention that Carlson and colleagues found statistically significant changes in diagnosis for EMDR, it does not explicitly mention the relative improvement in remission of PTSD, which was 77% in the EMDR group, compared to the 22% in the comparison treatment group.

The IOM report mistakenly stated that the study by van der Kolk et al. (2007) "failed to show significant improvement" (p. 112). Conversely, the study clearly demonstrated, in pairwise comparisons of the three conditions, that at posttreatment and follow- up EMDR was significantly superior to placebo in reducing PTSD symptoms and that at posttreatment EMDR showed a greater loss of diagnostic status compared with placebo (88% vs. 65%, respectively). The committee was correct in implying that at post- treatment, the drop in total CAPS score was

not significantly different between the two active treatment groups (59.0% for EMDR, 46.0% for fluoxetine). However, the committee diminished the importance of evidence provided by this study by not noting that at 6-month follow-up, EMDR was superior to fluoxetine in maintaining a reduction of PTSD symptoms. At follow-up, the CAPS total score drop was 62.2% for EMDR and 48.3% for fluoxetine, indicating that the fluoxetine group lost some of its gains, while the EMDR group continued to improve over time. The IOM report also failed to mention that at follow-up, 75% of adult-onset versus 33.3% of child-onset trauma EMDR participants achieved asymptomatic end-state functioning, compared to none in the fluoxetine group. This finding offers impressive support for the efficacy of EMDR in treating PTSD.

The IOM report also mentioned research by Tay- lor et al. (2003) and Vaughan et al. (1994) and, despite considering these studies to have major limitations, the committee added that "in any case neither demonstrated a statistically significant benefit" (p. 112). This claim is misleading, as in the Vaughan study all active treatments, including EMDR, led to significant decreases in PTSD symptoms compared to the wait list. This finding alone necessitates its inclusion into the assessment of evidence that supports the efficacy of EMDR in treating PTSD. In addition, Vaughan and colleagues found that a difference existed between treatment groups: EMDR participants reported a significantly greater reduction in reexperiencing/intrusive symptoms compared to other groups at the end of treatment that further improved at follow-up. It is worth noting also that the equivalent effects between treatment groups were obtained even though EMDR involved less treatment time.

Excluded Studies in Support of EMDR Without Apparent Justification

The IOM review considered but excluded, without apparent justification, a number of studies that pro- vide evidence for the effectiveness of EMDR. For ex- ample, the IOM report stated that research by Rogers et al. (1999) was excluded from the review because the trial "did not include a comparison or control group" (p. 112). This study, however, did include a direct comparison of EMDR to exposure, using two randomly as- signed groups of Vietnam veterans with PTSD who were treated with either EMDR or exposure.

In addition, in the summary of evidence for EMDR, it is not stated why the study by Lee et al. (2002) was excluded. It is recognized from the exposure therapy evidence tables that the committee considered one principal limitation of the study to be that the handling of dropouts was not reported or was unclear. However, in a related footnote. it was stated that "it is unclear from the author's reporting how many people were randomized. 29 were screened, 2 dropped out before randomisation" (p. 111). Lee and colleagues, in a detailed description of their

participant selection process and study procedure, clearly reported that 27 participants were randomly allocated to the treatment conditions, and the "assignment of the first participant was via a coin toss" (p. 1075). Within the same footnote in the IOM report, a following concern was raised in that an additional dropout occurred, as one participant went to prison, and the treatment condition of this participant was unclear. The treatment condition in this case, however, appears irrelevant, as the reason for dropout cannot be attributed to being a result of any particular treatment. Overall, despite these concerns, the dropout rate in this study, after randomization, was only one participant from each treatment group (less than 10% for each group) and therefore should have been included by the commit- tee's criteria whereby "up to 10% missing outcome data [is] acceptable without formal missing data methods employed" (p. 5).

Also excluded from the review for reasons that were unclear was a study by Wilson et al. (1995). The IOM report stated that this study was excluded, as "less than half of the 1995 study participants met PTSD diagnosis. Separate results for those with and without PTSD [were] not provided except for one supplemental analysis for those with PTSD" (p. 113). It is unfortunate, however, that Wilson et al.'s (1997) follow-up study was overlooked in an earlier draft of the IOM report and then excluded in the final report, as this publication contains the most complete data set and separate analyses of results for the participants (n = 32) who met full DSM-IV diagnostic criteria for PTSD pretreatment according to the Diagnostic and Statistical Manual of Mental Disorders (4th ed.). Thus, the analyses conducted by Wilson et al. (1997) negate the reason the committee provided for excluding their 1995 study. Although the IOM report does acknowledge this subsequent separate analyses of PTSD versus non-PTSD participants, the committee considered the Wilson et al. (1997) study "uninformative with regard to the core question of efficacy" because of the nature of the original delayed-treatment design, which there- fore resulted in the follow up study having no direct control group (p. 113). It is unfortunate that the study by Wilson and colleagues was not considered in its entirety, as this is one of the longest-term follow-up studies on PTSD that exists, with one of the largest group of participants. The follow-up publication reported average effect sizes for the fully PTSD group of 3.48 immediately after treatment, 3.96 at 3-month follow- up (with no attrition), and 3.84 at 15-month follow-up. It should also be noted that Wilson and colleagues, in their supplementary analyses, found that participants diagnosed with PTSD improved as much as those with partial PTSD. The improvements found in all partici- pants who received EMDR were substantial, with an overall 84% reduction in PTSD diagnoses and a 68% reduction in PTSD symptoms. Therefore, this study demonstrates not only the effectiveness of EMDR but also the durability of treatment effects.

Considered in the IOM report was a study by Roth- baum (1997) and a study by Marcus, Marquis, and Sakai (1997). Both studies were pronounced by the commit- tee as having "major

limitations" (p. 99). However in the descriptive evidence table, the only limitation noted for Rothbaum's study was that "dropout or completer numbers [were] not made clear" (p. 115). An accompanying footnote correctly pointed out that "the article states that two of the three patients who dropped out were assigned to WL, so one could conclude that the third patient that dropped out was probably assigned to EMDR. If that is true, the dropout rates would have been 91% and 80% for EMDR and WL, respectively" (p. 117). Not to mention also that this third participant completed only pretreatment assessment and then "found out she was pregnant immediately after assessment and decided not to continue" (Rothbaum, 1997, p. 322).

As with the study by Lee et al. (2002), the treatment condition in this case appears irrelevant, as the rea- son for dropout cannot be attributed to being a result of any particular treatment. Therefore, Rothbaum's study does not appear to have major limitations. In- stead, this study, in which the authors found that at posttreatment 90% of EMDR participants no longer met PTSD criteria for PTSD compared to 12% of control participants, should be considered as evidence for the efficacy for EMDR in the treatment of PTSD.

The IOM report also claimed that Marcus et al. (1997) had major limitations in that "dropout or completer numbers [were] not clear" (p. 115). In this study, only 1 participant out of 68 dropped out (again, less than 10% of the sample). A further comment made in the report regarding this study was that "blind assessment was affected by client revelations" (p. 117). Marcus and colleagues did report that an independent evaluator conducted interviews and scored all tests; however, "due to the strong subject response to EMDR, it was not possible to keep the independent evaluator blind to treatment condition. She was, however, blind to treatment methods used in SC [standard care group] . . . and was unfamiliar with EMDR" (p. 309). In the summary of evidence for EMDR, the IOM also failed to consider the 2004 publication of this research by Marcus and colleagues in which 6-month follow-up data were reported, demonstrating that a relatively small number of EMDR sessions results in substantial benefits that are maintained and that continue to improve over time.

Failed to Consider Additional Readily Available Studies in Support of EMDR

Despite the extensive search of the published lit- erature on the treatment for PTSD, the IOM committee, in its assessment of the evidence for EMDR, failed to consider a number of published studies in support of EMDR that were readily available (i.e., through MEDLINE and PsycINFO). For example, in an earlier draft of the IOM report, the committee failed to consider a study by Ironson et al. (2002) that compared EMDR to prolonged exposure (PE). In the final publication of the IOM report, the committee acknowledged within the summary of evidence

for exposure therapies that "after this report was released an additional head-to-head study was brought to the committee's attention (Ironson et al., 2002)" (p. 98). However, it appears that the study then received only a cursory examination. For instance, the committee went on to state that "because of lack of clarity regarding inclusion criteria, the randomization protocol, and the treatment actually delivered, the study was uninformative regarding the principal comparison of PE to EMDR" (p. 98). These comments are, how- ever, unjustified, as Ironson and colleagues provided a clear and comprehensive description of their inclusion criteria, and design considerations, such as the random assignment to conditions, clearly explained how assignment to conditions occurred after more participants dropped out of the PE condition com- pared to the EMDR condition (pp. 116–117). Ironson and colleagues also provided detailed descriptions of the manualized treatments protocols delivered (i.e., Foa & Rothbaum, 1998; Shapiro, 1995) and the fidelity checks conducted for both treatment conditions.

An additional concern, however, is that although a reference to the Ironson study was added in the exclusion notes within the summary of evidence for EMDR in the final IOM report, the citation followed a statement that implied that the study was excluded because it "did not include a comparison or control group" (p. 112). This statement is groundless, and the committee was aware, from its comments made about the study in the exposure section, that the re- search was in fact a direct comparison of PE to EMDR. Although reference was made to the Ironson study in the final IOM report, key information about the study was not mentioned in any evidence table, nor were the main findings of the study acknowledged anywhere within the report. Ironson and colleagues found that both treatments, EMDR and PE, produced a signifi- cant reduction in PTSD. The authors also found that EMDR attained a more rapid reduction of symptoms, as 70% of the EMDR participants had a 70% reduction in PTSD symptoms after three sessions, compared to only 22% of the PE group.

Another study in support of EMDR not mentioned in the IOM report was Edmond et al. (1999). This study, through a randomized design, examined the effectiveness of EMDR and routine treatment in treat- ing adult survivors of childhood sexual abuse. A major limitation, however, was that a diagnosis of PTSD was not a prerequisite for inclusion in the study. How- ever, the authors did use outcome measures that are commonly used to assess symptomatology associated with trauma, such as the Impact of Events Scale (IES; Horowitz, Wilner, & Alvarez, 1979), the STAI, and the BDI. Although instruments such as the IES cannot be used to establish a diagnosis of PTSD, the mean score of 38.7 for the EMDR treatment group indicates that this group was experiencing a high level of post- traumatic stress. The IES is also sensitive for detecting treatment effects (Weiss & Marmar, 1997), and in this study IES scores for the EMDR group reduced to 14.1 at posttreatment and to 10.3 at 3-month follow- up. Despite the limitations of this study, these findings advance the empirical knowledge about the effectiveness of EMDR. The failure to mention the Edmund's study is inconsistent with the citing of

exposure-based studies that did not include formal diagnostic assessment (Foa, Hearst-Ikeda, & Perry, 1995).

Conclusions

Of the 25 clinical trials mentioned in the IOM report that have investigated the use of EMDR in PTSD treatment, the committee determined that only two support the effectiveness of EMDR in the treatment of PTSD (Hogberg et al., 2006; Rothbaum, Astin, & Marsteller, 2005). It is unfortunate that the committee came to the conclusion that "the evidence is inadequate to determine the efficacy of EMDR in the treatment of PTSD" (p. 112), as its report misrepresented the findings of three studies (Carlson et al., 1998; van der Kolk et al., 2007; Vaughan et al., 1994), considered but excluded a further six studies without apparent justification (Lee et al., 2002; Marcus et al., 1997; Rog- ers et al., 1999; Rothbaum, 1997; Wilson et al., 1995, 1997), and failed to consider two additional readily available studies that report benefits for EMDR (Edmond et al., 1999; Ironson et al., 2002).

The IOM report stated that its findings are not in- tended to influence clinical practice. However, the publication of the IOM report may have that effect, particularly given that it acknowledged that an underlying objective of the committee was "to reach evidence-based conclusions that would inform policy decisions" (p. 1) and that the purpose of the independent review was to make the "published report as sound as possible and to ensure that the report meets institutional standards for objectivity [and] evidence" (p. vii). Given the previously mentioned summary of errors and omissions noted in the committee's assessment of evidence on EMDR, there appears a real danger that policymakers and perhaps practitioners may make ill-informed decisions. Consequently, it is recommended either that the committee reconsider its conclusion regarding the efficacy of EMDR in the treatment of PTSD or that an amendment be posted that acknowledges some of the previously mentioned errors that exist within the report. To conclude, it is hoped that the Department of Veterans Affairs continues to support the use of EMDR in the treatment of PTSD. Veterans returning from current conflicts and now reentering civilian life with PTSD deserve no less than to receive the most effective treatment.

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Appendix B. Can eye movements treat trauma? Recent research supports the effectiveness of "eye movement desensitization and reprocessing"

Rodriquez, T. (2013). Can eye movements treat trauma? Recent research supports the effectiveness of "eye movement desensitization and reprocessing". *Scientific American.* Retrieved from http://www.scientificamerican.com/article/can-eye-movements-treat-trauma/

H E A L T H

Can Eye Movements Treat Trauma?

Recent research supports the effectiveness of "eye movement desensitization and reprocessing"

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- By Tori Rodriguez on January 1, 2013

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KARIN DREYER Corbis

Imagine you are trying to put a traumatic event behind you. Your therapist asks you to recall the memory in detail while rapidly moving your eyes back and forth, as if you are watching a high-speed Ping-Pong match. The sensation is strange, but many therapists and patients swear by the technique, called eye movement desensitization and reprocessing (EMDR). Although skeptics continue to question EMDR's usefulness, recent research supports the idea that the eye movements indeed help to reduce symptoms of post-traumatic stress disorder (PTSD).

Much of the EMDR debate hinges on the issue of whether the eye movements have any benefit or whether other aspects of the therapeutic process account for patients' improvement. The first phase of EMDR resembles the start of most psychotherapeutic relationships: a therapist inquires about the patient's issues, early life events, and desired goals to achieve rapport and a level of comfort. The second phase is preparing the client to mentally revisit the traumatic event, which might involve helping the person learn ways to self-soothe, for example. Finally, the memory processing itself is similar to other exposure-based therapies, minus the eye movements. Some experts argue that these other components of EMDR have been shown to be beneficial as part of other therapy regimens, so the eye movements may not deserve any of the credit. New studies suggest, however, that they do.

In a January 2011 study in the *Journal of Anxiety Disorders*, for example, some patients with PTSD went through a session of EMDR while others completed all the components of a typical EMDR session but kept their eyes closed rather than moving them. The patients whose session included eye movements reported a more significant reduction in distress than did patients in the control group. Their level of physiological arousal, another common symptom of PTSD, also decreased during the eye movements, as measured by the amount of sweat on their skin.

One of the ways EMDR's eye movements are thought to reduce PTSD symptoms is by stripping troubling memories of their vividness and the distress they cause. A study in the May 2012 *Behaviour Research and Therapy* examined the effectiveness of using beep tones instead of eye movements during EMDR. The researchers found that eye movements outperformed tones in reducing the vividness and emotional intensity of memories.

Those studies relied on self-reports of symptom severity, however, so researchers at Utrecht University in the Netherlands sought more objective confirmation of a change in vividness by also measuring participants' reaction times to fragments of a previously viewed picture. The work, published online in July 2012 in *Cognition and Emotion*, compared two groups of participants who had committed one detailed picture to memory. When asked to recall the picture and focus on it mentally, one group was instructed to perform eye movements. That group had slower reaction times to the familiar picture fragments

in a subsequent memory test, and subjects reported that the vividness of the recalled pictures had decreased.

These studies and others from the past several years have helped validate EMDR—so much so that the American Psychiatric Association, the International Society for Traumatic Stress Studies, and the Departments of Defense and of Veterans Affairs have deemed it an effective therapy.

Yet how it works remains unclear. Chris Lee, a psychologist at Murdoch University in Australia and co-author of the January 2011 study, says a common theory is that EMDR takes advantage of memory reconsolidation: every time we recall a memory, it is changed subtly when we file it away again. For instance, parts of the memory may be left out, or new ideas and feelings are stored alongside of it. Making eye movements during recall, Lee explains, may compete with the recollection for space in our working memory, which causes the trauma memory to be less intense when recalled again.

"Our experiments clearly show that negative autobiographical memories are very rich in sensory detail, and by pairing them with eye movements, they lose this sensory richness," Lee says. "People describe that the memories become less vivid and more distant, that they seem further in the past and harder to focus on. What follows after this distancing is a reduction in the associated emotional levels." In other words, the traumatic memory stays, but its power has been diminished.

This article was originally published with the title "Can Eye Movements Treat Trauma?"

Appendix C. The eyes have it in trauma therapy

The eyes have it in trauma therapy

Inducing rapid eye movements during therapy helps patients suffering trauma-induced psychological disorders overcome negative thoughts and stress, according to Murdoch University research.

Eye movement desensitisation and reprocessing (EMDR) therapy first emerged in the late 1980s and has since become a clinically proved treatment for patients with post-traumatic stress disorder.

In new findings, Murdoch University PhD candidate Sarah Schubert found the eye movements were a critical element in the success of EMDR therapy, responsible for reducing the emotional impact of trauma as well as providing physiological benefits.

"EMDR is based on an assumption that we as humans naturally want to heal. In PTSD or trauma the brain doesn't naturally process information like it normally would," she said.

"If something bad has happened to us in the past we avoid thinking about it and the natural healing process that occurs in sleep is disrupted (by nightmares).

"EMDR is an intervention which kickstarts the natural healing process of the brain and creates a safe place in therapy for the brain to heal in the way it needs to, to make sense of what has happened in the past."

EMDR is an eight-phase treatment which brings together elements of effective therapies including cognitive therapy, physiological and somatic therapies as well as bilateral stimulation involving eye movements, tones or tapping.

During the desensitisation phase of EMDR patients are asked to think about traumatic events and the associated negative thoughts while following a therapist's fingers moving back and forth in front of their eyes.

"The aim of the eye movements is to keep people focused on the memory but we don't want them to relive it," Ms Schubert said. "We just want them to think about it and freely associate and let the brain process whatever it needs to process.

"You want them to replace those negative thoughts (associated with the trauma) with positive ones like 'I'm safe now' and 'I'm in control now'."

In her research Ms Schubert found that it was these eye movements that helped create a relaxation response, reducing heart rate, sweating and heart rate variability, and easing emotional distress.

She conducted therapy sessions with 62 volunteers, who were not clinically diagnosed as having PTSD but who had experienced trauma such as physical abuse or the death of a family member.

The volunteers were divided into two groups, one which underwent EMDR with the eye movements and one without.

Ms Schubert said the group that underwent EMDR with the eye movements clearly experienced better outcomes.

"We found distress levels were significantly lower in the eye-movement group compared to when they were removed from the procedure," she said.

While the reason why these eye movements work remains inconclusive, Ms Schubert said other researchers had theorised that inducing the eye movements while thinking about the trauma overloaded the working memory part of the brain — pushing out the trauma memories and allowing them to be processed and transferred to long-term memory where they were no longer distressing.

"We know EMDR works and the eye movements matter but we need further research to really specifically say how these things actually work," she said.

"(At the end of therapy) the memories aren't distressing anymore. (Patients) have a full belief in the positive thoughts about themselves."

Ms Schubert plans to travel to East Timor to further research the effectiveness of EMDR among the big section of the community there suffering PTSD.

Appendix D. Logistical framework for Timor Leste project

Table …

Logistical Framework for Timor Leste Project.

ACTIVITY	MATERIAL/ EQUIPMENT/ PROVISIONS/	ASUMPTIONS	ACTION TAKEN
Selecting and Preparing Translators Time Required: 4 days Persons involved: -Sarah -Dilyana -Translators	-Selection criteria -Language test -Training material -Learning resources -Information pamphlets (with contact details) -Stationary -Food/drinks	-That translators will have a background in mental health or related community development area -That translators are culturally appropriate (i.e. gender, ethnicity, history) thus are able to work in close proximity with participants. -That translation skills are such that the Translator is able to adequately convey information to therapist. -That translators will be able to grasp the concept of EMDR, EMDR related processes and terminology and be able to assist Therapist in its delivery -That translators will be available for sessions, be able to access appropriate equipment to carry out their duties, and be willing to work	-Candidates will be recruited based on their ability to show previous experience and appropriate sensitivity in working with victims of trauma and demonstrated fluency in Tetun/ English/ Bahassa as required. All selection criteria will be addressed and referees contacted prior to employment arrangements being finalised. -All recruitment interviews will be overseen by a Timor-Leste psychologist (Dillyana Daten) with over 10 years experience working in the field of Mental Health and community development in Timor-Leste -Translators will be trained in the therapy in order that they: understand and are familiar with process of therapy; understand terminology and imagery; are able to anticipate and recognise reactions and abreactions; and can communicate effectively with therapist. -Translators will be renumerated for their work in accordance with national wage average. A full research schedule will be provided to translators prior to commencement to allow for scheduling. Translators will be provided with access to Laptop, stationary, and learning resources as required (and this equipment will be donated and left behind once the project is complete. One laptop has already been provided for Dillyana Daten). Phone cards will also be provided to translators.
Preparing Mental Health workers/ staff Time required: 1 day x 2 sessions Persons involved: -Sarah -Translator -NGO supervisor -Mental health workers	-Training Material -Learning resources -Information pamphlets (with contact details) -Stationary -Food/drinks	-That the cooperation of NGO's will be secured. -That MH workers will have some familiarity with EMDR processes and terminology prior to information session. -That MH workers are able to attend information session and are willing to participate in the project. -That MH workers will be able to provide feedback to Therapists on appropriate ways of working with clients, identify potential problems and how these might be circumvented -That MH workers understand matters of confidentiality and consent.	-The Initial visit to Timor Leste led to commitment from NGOs to engage in the project. Dillyana Daten remains in contact with the NGOs to ensure continued commitment to the project. -MH workers will participate in an information workshop about the project and also RDI training workshops that will introduce basic techniques and processes associated with EMDR therapy. -The plan will be to hold the information session on a work day that suits both the NGO and staff. I will be open to running two information sessions for each NGO if needed. -Weekly meetings will be held with NGO staff and also translators so that ongoing feedback about the project can be given, any problems raised, discussed, and resolved. -Issues of confidentiality and consent will be discussed at each information session, and throughout the project duration as required.

ACTIVITY	MATERIAL/ EQUIPMENT/ PROVISIONS/	ASUMPTIONS	ACTION TAKEN
Selecting and Preparing Participants (cont ...) Time required: 1 week. Ongoing.	-Training Material -Learning resources -Information pamphlets (with contact details) -Stationary -Food/drinks	-That participants will be willing to participate. -That participants have the appropriate support network, emotional resources and living environment to be able to cope with therapeutic intervention. -That due to their outward humility and politeness some Timorese may agree to participate rather than offend making consent an issue. -That due to illiteracy and unfamiliarity with western notions of psychology including conceptualization of mind body divide, participants may find it difficult to comprehend therapy making informed consent an issue -That some participants may have idiosyncratic ways of interpreting the mechanisms behind EMDR (i.e. sorcery) which could complicate the role of therapist and use of technique.	- An initial visit to Timor explored if people would be interested and willing to engage in this project. -Participants will be selected from live-in mental health facilities which provide 24hr/7 day accommodation and support services to trauma sufferers. Participants will have access to NGO services throughout their participation. - The capacity for MH workers to provide appropriate support will be built in initial education session and throughout the study. Interview sessions will be used to screen participants who are not suitable for participation in the study - Therapists will also be available for ongoing and emergency support in study and in follow-up. -The issue of consent will be discussed at length during information sessions with NGO staff. -Mental health workers, translators, and therapists will talk to potential participants and make it clear that they are not under any obligation to take part in the study and they are free to withdraw at any time. -Participants will be fully informed and able to consent to participation in the study. Therapists and MH workers will treat potential participants with understanding and respect and properly communicate in simple language to clients their rights including: confidentiality, privacy and freedom to consent or decline to participate in the project or any condition thereof at any stage -Consent will be reassessed verbally prior to each treatment session. -Communicate to participants the basic theory behind EMDR and why it may work in order to avoid recourse to alternate and potentially damaging interpretations.
Initial assessment session/ History taking Time required: 1.5 hrs x 2 sessions x 40 clients Persons involved: -Therapist -Translator -Participant	- treatment room -information and consent script -contact card	-That due to the historical reality of Timorese society once revolving around debt accumulation and indebtedness to others, some participants may have expectations that the sharing of personal information will result in additional future payment of some kind. -Due to other priorities and unfamiliarity with western time keeping schedules, some participants may find it difficult to endure entire sessions or may not show up to planned sessions. -After the initial session participants may feel unable to continue but feel uncomfortable to say so -Due to the cultural belief in balancing opposites, exchange of information between therapist and client will be expected.	-It will be made clear in information sessions with mental health workers that 'payment' is in the form of receiving therapy to treat their trauma symptoms. Other than the reimbursement of travel costs, light snacks and drinks, it will be made clear to participants that there will be no other form of payment. - Explaining to people that this is a student project and people working with the project are volunteering their time make other forms of payment less expected. -Participants will be live in residents of NGOs. -Time schedules for treatment sessions will be flexible and work around women's daily schedules. -Consent will be reassessed at the beginning of every session, and participant's will be reminded of their ethical right to withdraw. -The therapist's introduction will involve some self-disclosure of personal information (i.e. discussing family, that I am a student, where I work). It will be explained to each participant why the therapist is in Timor, that we are psychologists, volunteering time for this project.

ACTIVITY	MATERIAL/ EQUIPMENT/ PROVISIONS/	ASUMPTIONS	ACTION TAKEN
Administration of Measures Time required: 40 min x 40 clients x 3 time points (pre, post, follow-up) Persons involved: -Therapist -Translator -Participant	-Translated measures -Visual scales that are culturally appropriate	-Some participants will be illiterate and/or unfamiliar with Western concepts of measurement and questionnaire formats making these difficult to complete -It will be easy to receive a wrong answer to questions, especially leading questions, merely because most people will only be trying to show good manners.	-The use of measures will be explained and discussed in the information session to NGO staff. -Alternative measurement devises/aids will be constructed (i.e. pictorial scales) to aid self report measurement. -Measures will be translated and will be administered verbally. -Measures will be translated and adapted to reflect the true intent of the question rather than word for word translation. Back translation will be used in the translation process to check the appropriateness of the adaptations made in translation. -Therapists and translators will explain intent of measures so that clients understand. -It will also be stressed that what we are after in response to questions is the truth about what they think and feel, and that we are not wanting the responses that participants think we may want to hear, and that saying the truth is the way I will best be able to help you.
Administration of Measures (cont…)		-The language and phraseology of some questions is distinctly western. -That patient information is kept secure and private	-Back translation of measures will be used to check for the appropriateness of translation. -Translators will be able to provide ongoing feedback about the appropriateness or any problems associated with the measures/questionnaires. -A system of securing confidential information will be put in place and participants will be made aware of this.
EMDR Therapy sessions 1-10 Time required: 1-1.5 hrs x 10 sessions x 40 clients Persons involved: -Therapist -Translator -Participant	-Session protocols. -EDMR therapy prompt sheet with Timor appropriate metaphors. -Physiological measuring/ recording equipment. -EMDR session record forms.	-That participants will not be adversely affected by therapy. -That participants will not be familiar with psychological terms, metaphors, symbols, methods and that some procedures in the standard EMDR protocol may be inappropriate for use in therapy with particular clients. -That participants may not show up -That only some clients will allow physiological measures.	-Knowledge of EMDR literature (i.e. RCT evidence),and familiarity of evidence from EMDR being used to treat PTSD in other cultures, speaking to people who have used EMDR in other cultures indicates that EMDR treatment will benefit participants and will not cause harm. -To discuss the treatment protocol, the participant explanations for the rational and the therapy procedure with translators prior to seeing clients to make the descriptions as culturally appropriate as possible. -Be prepared to adjust the protocol to suit each client (i.e. omit negative and positive cognitions). -Participants will be living in NGO shelters, and we will be meeting clients there rather than expecting participants to meet therapists. - Physiological measures will only be taken when informed consent has been given for this.

ACTIVITY	MATERIAL/ EQUIPMENT/ PROVISIONS/	ASUMPTIONS	ACTION TAKEN
EMDR Therapy sessions 1-10 (cont ...)		-That unexpected reactions may be encountered.	-Safety procedures are built into the EMDR procedure to respond to strong negative emotional reactions. Translators will be trained in what is expected in EDMR and will also be trained in the calming techniques so that they can guide the participants in these should unexpected reactions occur. Translators will receive training in how to identify reactions not common in EMDR. -Therapists will engage in ongoing, regular supervision throughout the project.
		-There will be a wide range of participants that differ in the level of trauma experienced, trauma symptoms present, their ability and ways of managing trauma symptoms, and also level of education and literacy.	-We aim to be fair and generous in inclusion into treatment. -A great deal of time will be allocated in the assessment sessions to attain an in depth understanding of each participant's past and present trauma related experiences. -In planning the procedure, measures, and the treatment protocol adjustments have been made in the protocol and the terms and metaphors used to explain the treatment to account to different types of participants and also different education and literacy levels (i.e. measures and consent will be read and responses attained verbally).
Follow-up Time required: 2 hrs x 40 clients Persons involved: -Therapist -Translator -Participant	-Follow-up protocol, including assessments. -Phone, transport, and room for assessor. -Stationary -Food/drinks	-That lasting effects of therapy will be beneficial. -That the majority of participants will be located at follow-up.	-This assumption has been made on the basis of the large body of literature that demonstrates that effectiveness of EMDR and the maintenance of the effects at follow-up. -Participants will be made aware that they will be contacted 3-months after the completion of treatment. Consent will be attained to contact them either at the NGO safe house, or at an address provided by the participant to the NGO should they leave the safe house during the 3 month follow-up period.