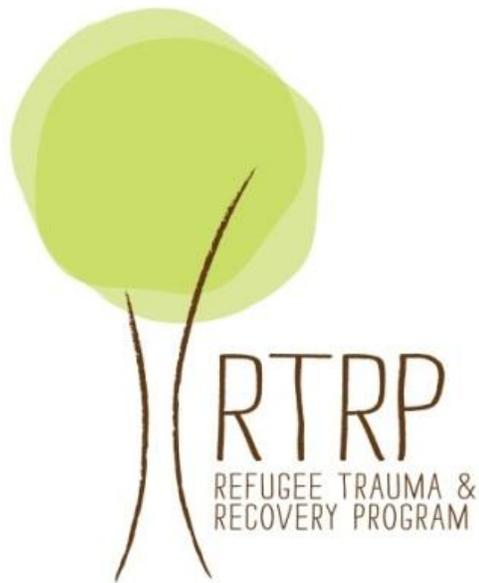


Latest on Neuroscience and Trauma

Belinda Liddell

School of Psychology, UNSW Australia
Refugee Trauma and Recovery Program (RTRP)

b.liddell@unsw.edu.au



Overview of talk

- Neural models of PTSD – the past and the future
- How can we understand the impact of refugee trauma on the brain?
 - Preliminary brain imaging evidence
- What is the role of culture?
 - Preliminary eye tracking and brain imaging evidence.

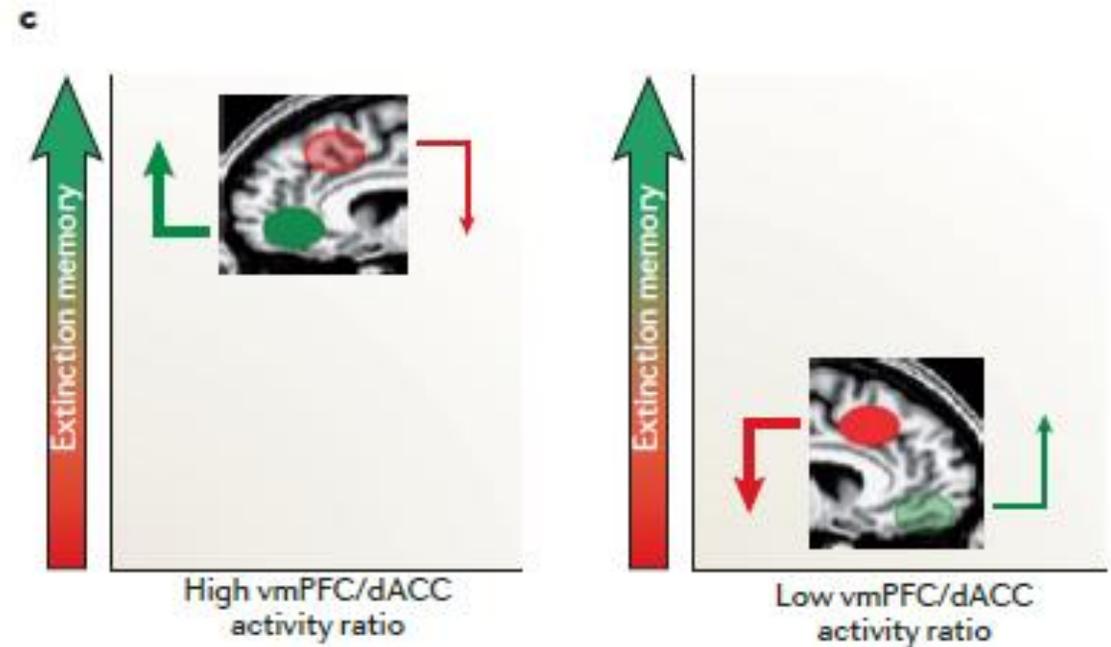
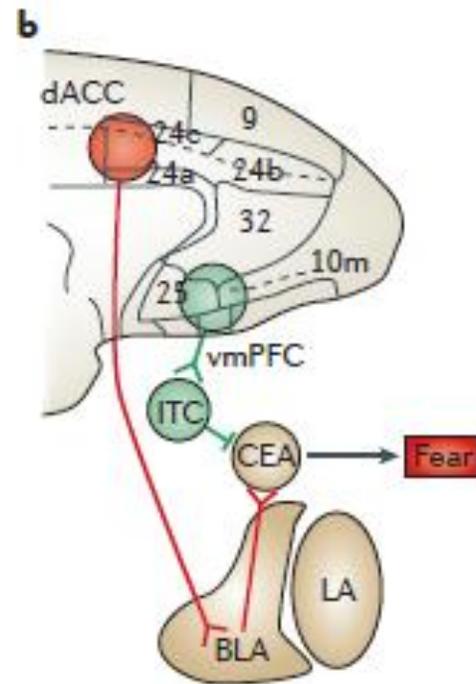
Neural Models of PTSD

1. Alterations in fear learning
2. Overactive threat detection
3. Diminished emotion regulation and executive function system

Neural Models of PTSD: Fear Learning

Healthy functioning

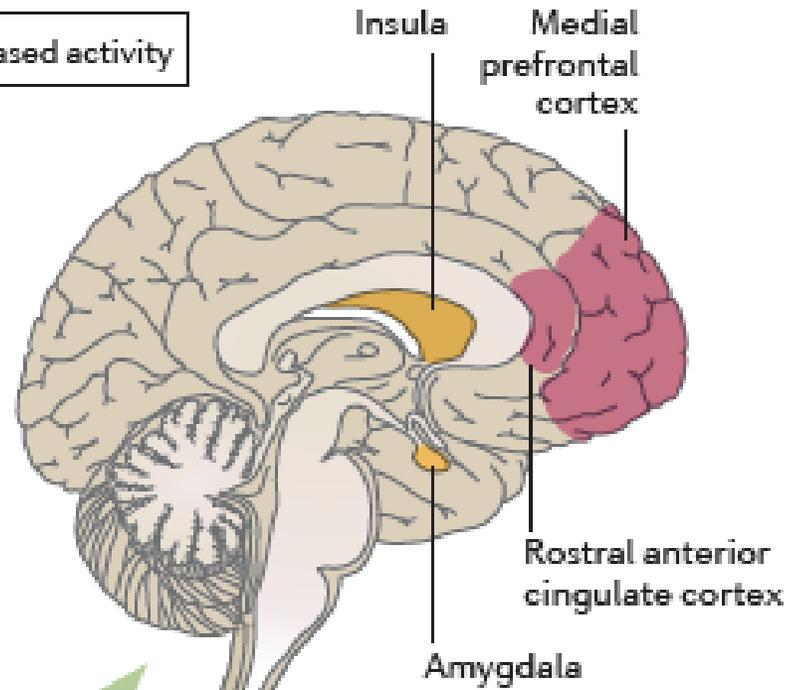
PTSD



From Pitman RK, Rasumusson AM, Koenen KC, Shin LM, Orr SP, Gilbertson MW, Milad MR, Liberzon I (2012). Biological studies of post-traumatic stress disorder. *Nature Reviews Neuroscience*, 13, 769-787; Adapted from Milad, M. R. *et al.* Recall of fear extinction in humans activates the ventromedial prefrontal cortex and hippocampus in concert. *Biol. Psychiatry* 62, 446-454 (2007)

Fear Circuitry Models of PTSD

■ Increased activity ■ Decreased activity



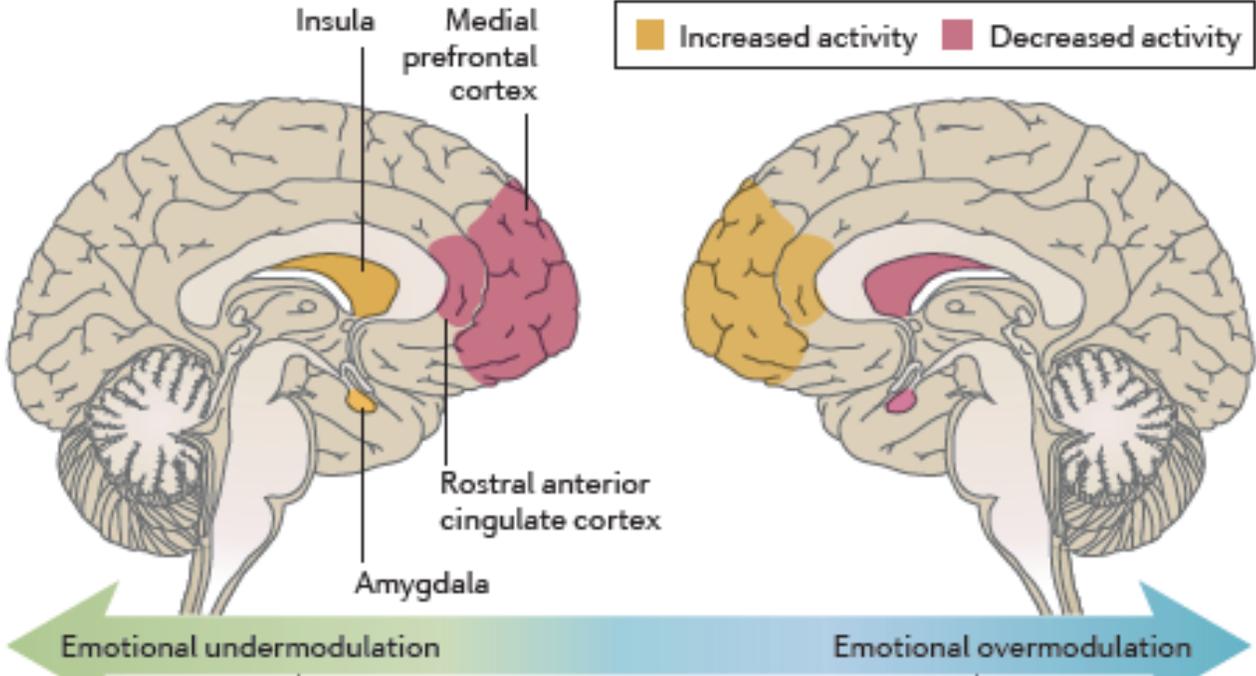
Current evidence base

Single incident trauma

Military trauma

High arousal
Intrusive trauma-related memories

Fear Circuitry Models of PTSD: Subtypes



High arousal
Intrusive trauma-related memories

Hypoarousal
Depersonalisation
Derealisation
Emotional numbing/withdrawal

Current evidence base

Sexual violence

Childhood maltreatment

Yeduda et al (2015); adapted from Lanius et al., (2010)

PTSD

- PTSD as a disorder is highly heterogeneous



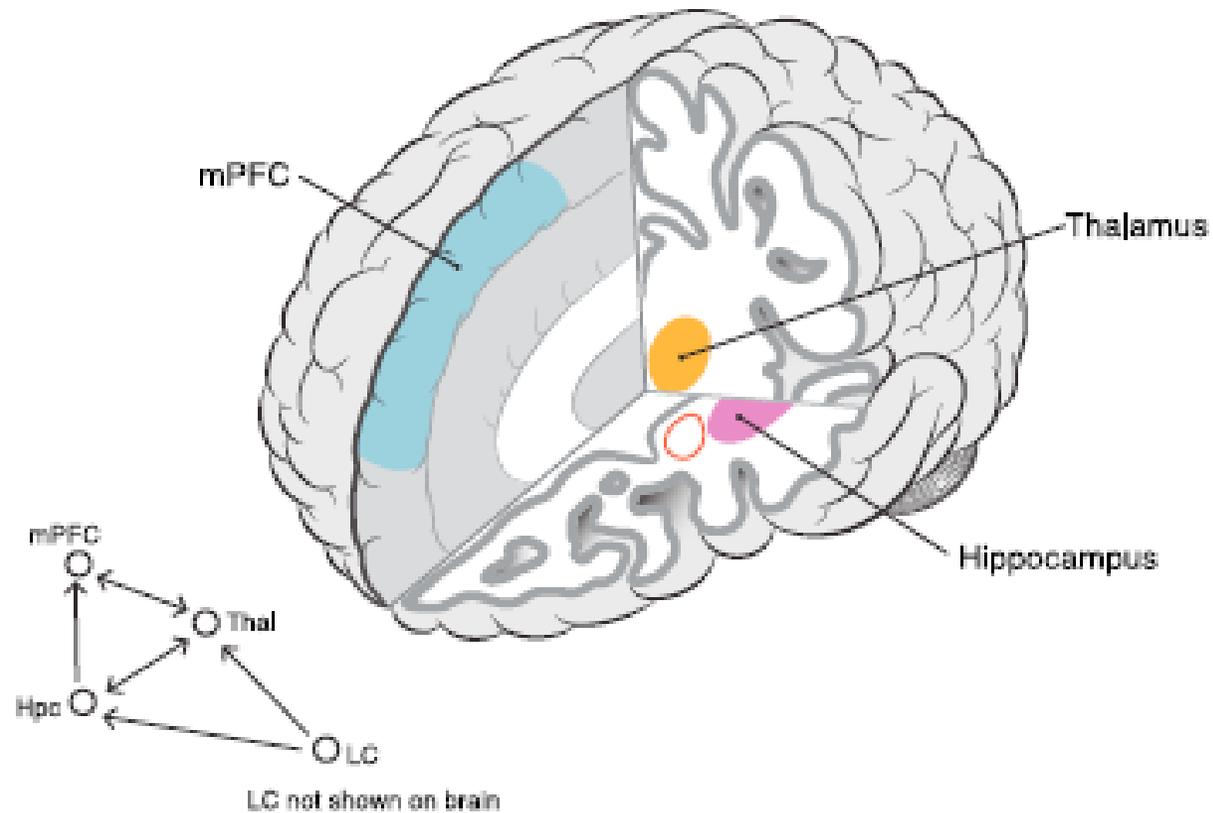
636,120 Ways to Have Posttraumatic Stress Disorder

Isaac R. Galatzer-Levy¹ and Richard A. Bryant²

¹New York University School of Medicine; and ²University of New South Wales, Kensington, New South Wales, Australia

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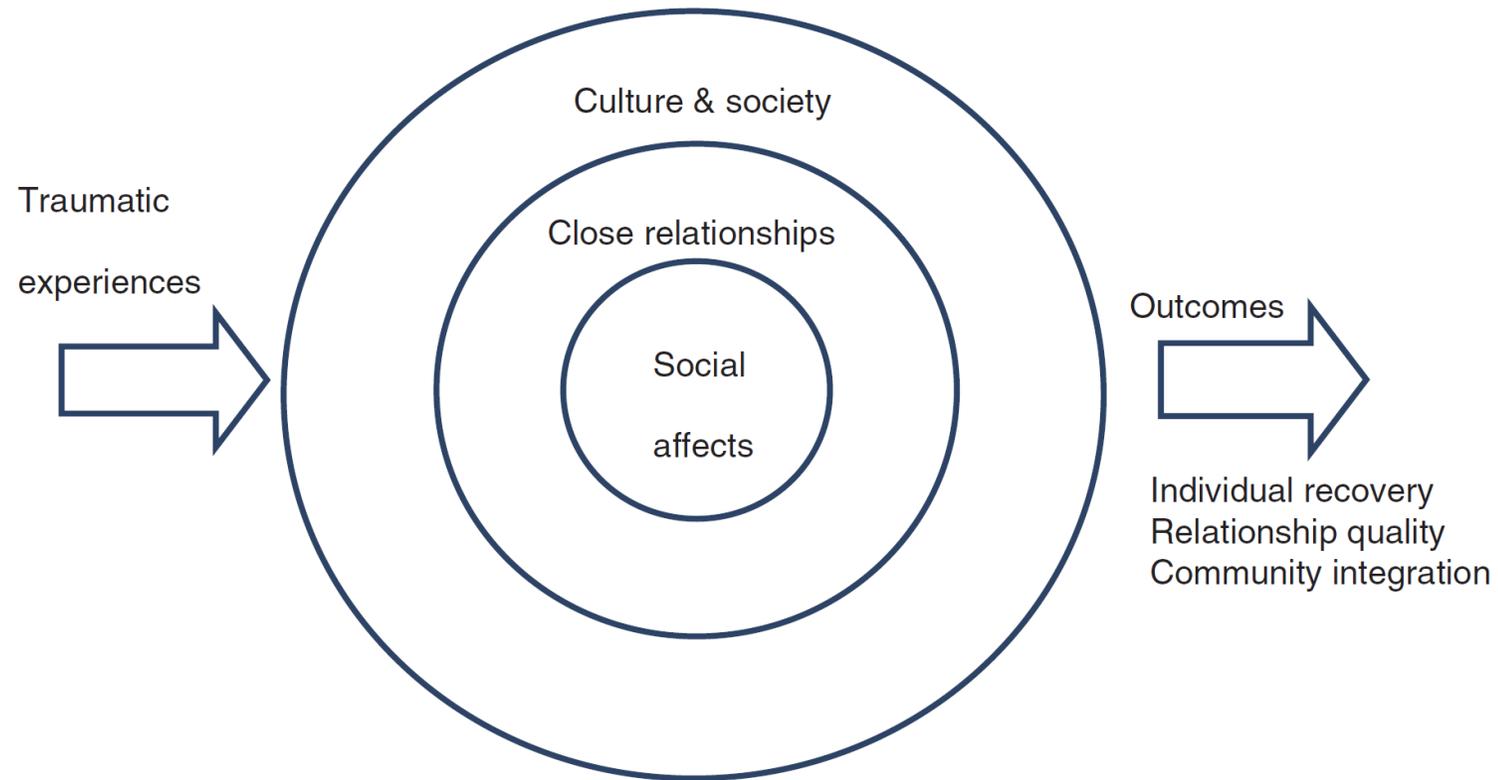
Deficient Context Processing



Core Affect Disturbances

- **Psychological constructionist approach** to emotion (Barrett, 2014).
 - No specific fear network (Kober et al., 2008)
 - Distributed brain systems that construct psychological states
- Core affect connects internal with external information to determine salience and behavioural response
- Exposure to trauma results in disturbance to this homeostasis, disrupting multiple brain systems and altering core affect (Suvak & Barrett, 2009)

Socio-Interpersonal Model of PTSD



Implications for neural substrates of PTSD?

- Culture impacts many of the same neural mechanisms known to be aberrant in PTSD (Liddell and Jobson, 2016):
 - ❖ Threat processing and emotion regulation
 - ❖ Attentional biases
 - ❖ Emotional and autobiographical memory
 - ❖ Self-referential processing
 - ❖ Interpersonal processing and attachment



REVIEW ARTICLE

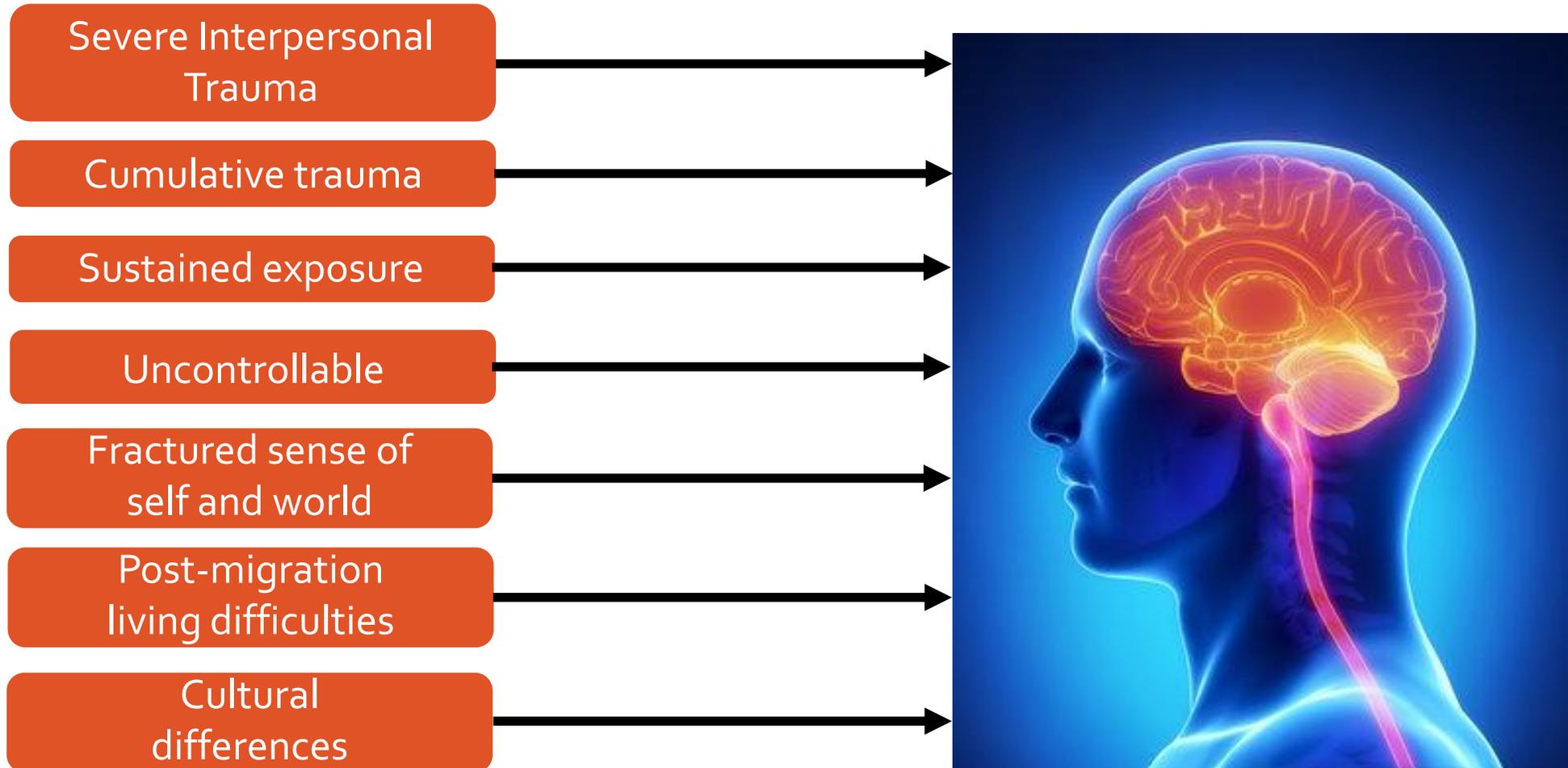
The impact of cultural differences in self-representation on the neural substrates of posttraumatic stress disorder

Belinda J. Liddell^{1*} and Laura Jobson^{2,3}

¹School of Psychology, University of New South Wales Australia, Sydney, Australia; ²School of Psychological Sciences, Monash University, Clayton, Australia; ³Monash Institute of Cognitive and Clinical Neurosciences, Clayton, Australia

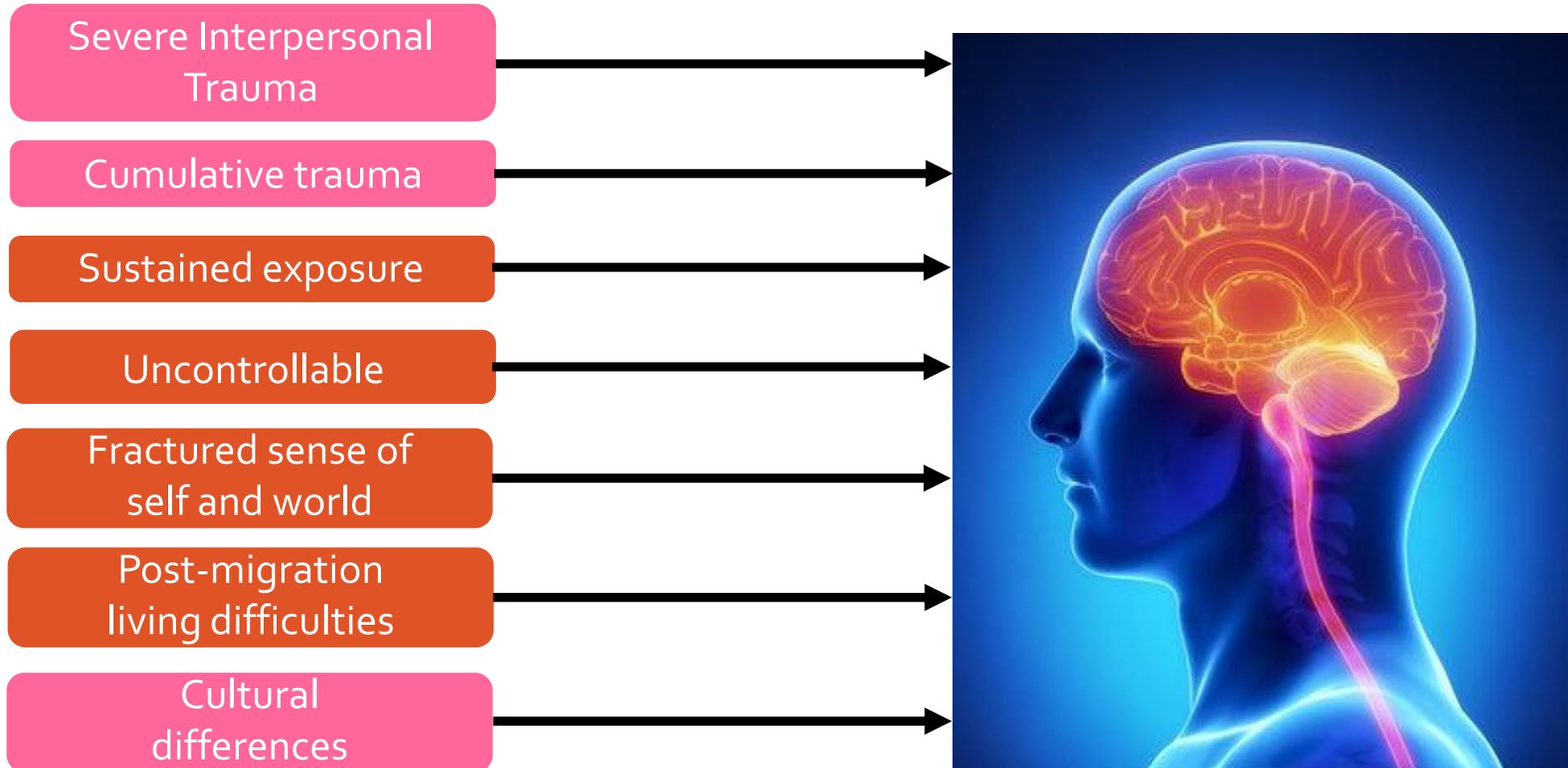
Refugee Trauma, Torture and the Brain

Characteristics of torture and refugee trauma



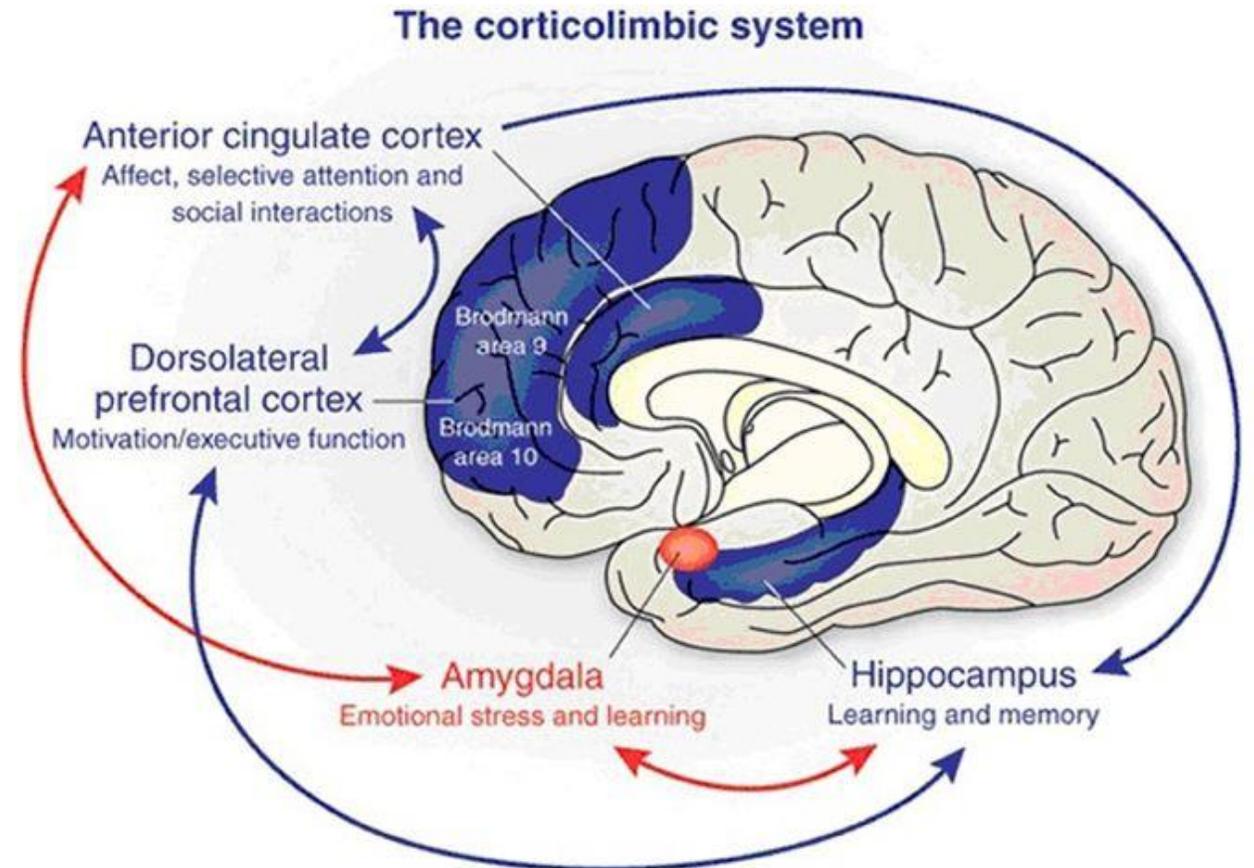
Refugee Trauma, Torture and the Brain

Characteristics of torture and refugee trauma



The impact of torture on brain structure

- Cortical thinning in prefrontal (anterior cingulate) and temporal regions (Eckart et al., 2011); also visual regions and cerebellum (Zanideh et al., 2016)
- Reduced hippocampal volume in torture survivors with PTSD (Zanideh et al., 2016)
- Evidence that cumulative nature and severity of trauma associated with reduced amygdala volume (Mollica et al., 2009)



The impact of torture on brain function

Anterior (front) view



Posterior (back) view



Healthy
Control

War and
trauma-
exposed
controls

War and torture
exposed
refugees with
PTSD

PTSD group showed:

- Early enhanced prefrontal activity – alarm system (Adenauer et al., 2010)
- Reduced later parietal-occipital activity later – subsequent disengagement from threat (Adenauer et al., 2010)
- Supports hypervigilance-avoidance model
- Degree of disengagement found to correlate with torture severity and dissociative symptoms (Catani et al, 2009)

What we don't know yet

- What are the specific effects of torture on the emotional brain?
 - Does torture exposure have a long term effect on the brain's threat processing systems regardless of PTSD symptoms?
- Do avoidance, emotional-numbing or dissociative symptoms have differential neural correlates according to whether a refugee is a torture survivor or not?
- How does refugee trauma accord with neural models of PTSD?

Participants

80 participants with a refugee background

Gender	67.5% males
Age	Average 38.2 years old, range 18-70 years
Country-of-origin	Iran (38.8%) Iraq (16.1%) Sri Lanka (7.5%) Afghanistan (5%) Range of other countries – Africa, Asian and South America (32.6%)
Number of trauma types	11.25 event types
% torture survivors	38.75%
Length of time in Aus	3.3 years, range 2 months – 30 years

Defining Torture

UN Convention Against Torture (UNCAT): 5 core characteristics of the event

1. Government or organized authority hurt or inflicted pain/suffering
2. Deliberate/intentional acts
3. For purposes of obtaining information/confession; punishment; intimidation or coercion
4. Results in severe pain and suffering
5. Not incurred as part of "legal" punishment regime

Torture Screening Check List (TSCL); Rasmussen et al (2012), J Psychology, 219, 143-149.

"any act by which severe pain or suffering, whether physical or mental, is intentionally inflicted on a person for such purposes as obtaining from him or a third person information or a confession, punishing him for an act he or a third person has committed or is suspected of having committed, or intimidating or coercing him or a third person, or for any reason based on discrimination of any kind, when such pain or suffering is inflicted by or at the instigation of or with the consent or acquiescence of a public official or other person acting in an official capacity. It does not include pain or suffering arising only from, inherent in or incidental to lawful sanctions". (Office of the United Nations High Commissioner for Human Rights, 1984).

Study procedure

Step 1: Referral and screening

STARTTS or self-referral



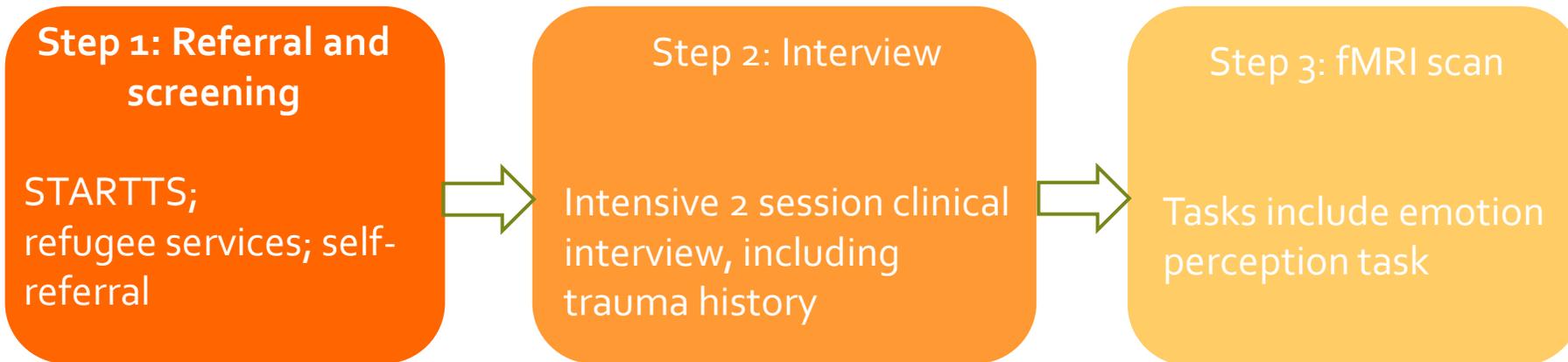
Step 2: Interview

Intensive 2 session clinical interview, including trauma history



- Symptoms measured via the Posttraumatic Symptoms Scale (DSM-V)
- Trauma history via the Harvard Trauma Questionnaire
- Torture Severity via Torture Experiences Questionnaire
- Current stress by the Postmigration Living Difficulties Scale (Steel et al., 2005)
- Dissociative symptoms - DES

Study procedure



Task



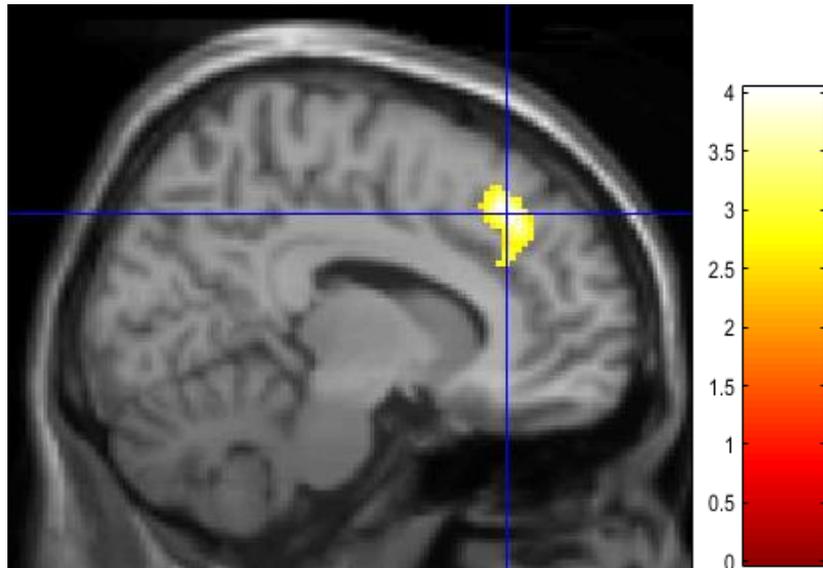
PTSD Symptoms and Trauma history

	Torture Survivors (n = 31)	Non – Torture Survivors (n=49)
PTSD Dx (DSM-V)	N = 13 (42%)	N = 19 (39%)
Trauma load	13.1 (SD 3.6) ***	10.1 (SD 3.2)
PTSD Symptom severity	27.8 (SD 14.0) *	21.6 (SD 13.9)
Re-experiencing	8.0 (SD 4.8) **	5.0 (SD 4.2)
Avoidance	2.7 (SD 1.9)	2.6 (SD 2.1)
Alterations in mood/cognition (emotional numbing)	9.5 (SD 5.7)	7.8 (SD 5.4)
Hyperarousal	7.6 (SD 4.8)	6.0 (SD 4.4)
Dissociative symptoms	13.4 (SD 12.8)	10.9 (SD 13.9)
Post-migration Living difficulties	44.2 (SD 11.6)	44.6 (SD 12.2)

***p<.001; ** p<.01; * p<.1

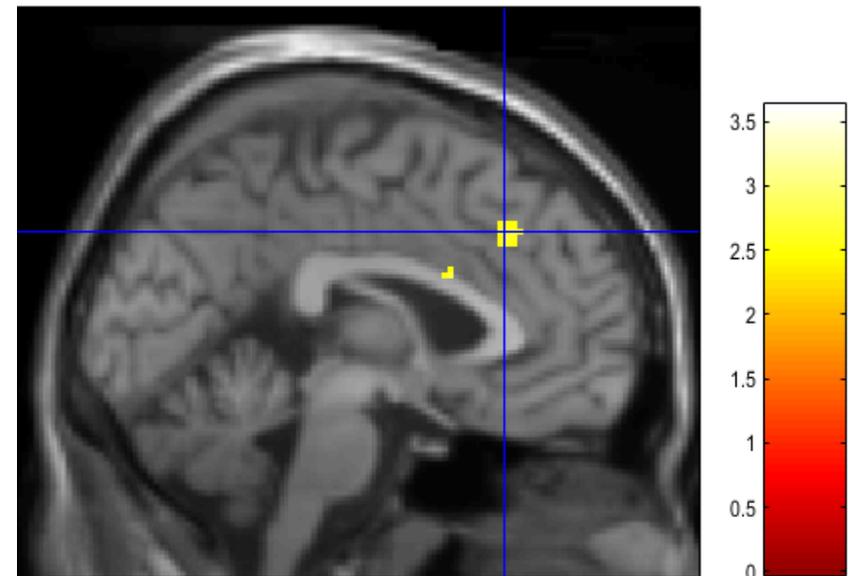
Correlates with Torture Severity and Trauma Load

In torture exposed group –
Correlates with greater torture severity



Dorsomedial prefrontal cortex
Dorsal anterior cingulate cortex

Torture Survivor > Non-Torture Survivor
Correlates with trauma dosage



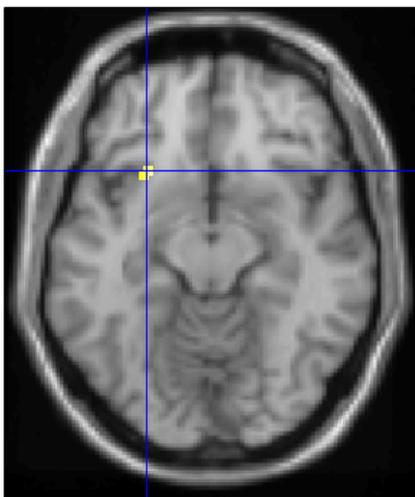
Bilateral dorsomedial prefrontal cortex

P<.05 FWE-corrected

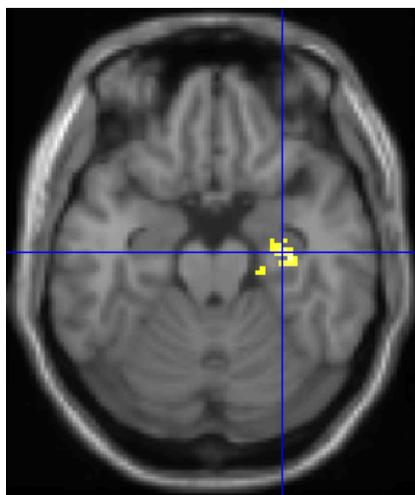
Correlates with Avoidance Symptoms

Torture Survivor cohort only

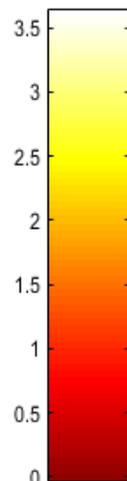
Increased avoidance symptoms



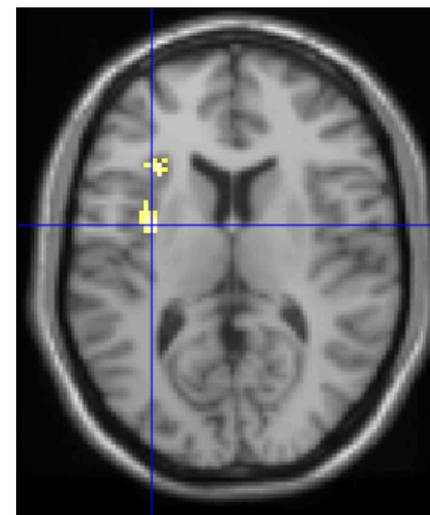
Left anterior insula



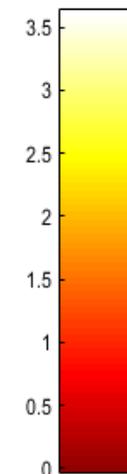
Right hippocampus



Torture Survivor > Non-Torture Survivor



Left anterior and posterior insula

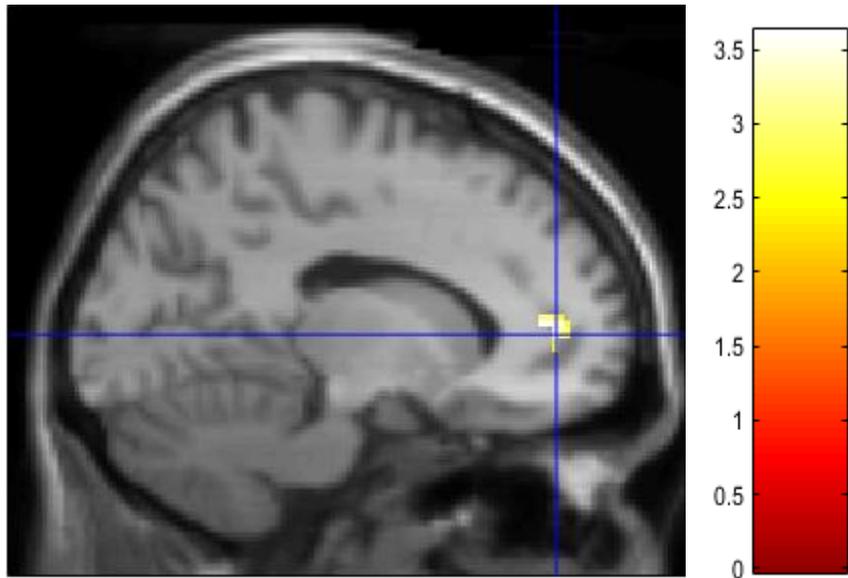


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Correlates with Emotional Numbing/Mood Symptoms

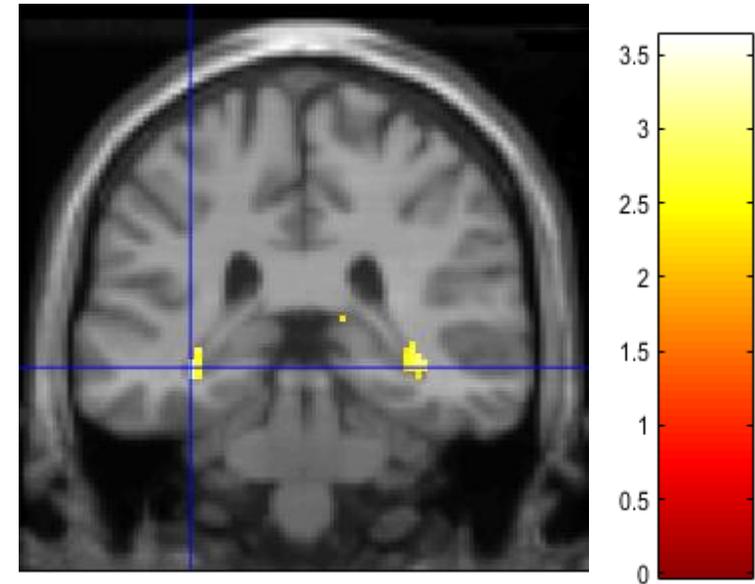
Torture Survivor cohort only

Decreased mood/cognition symptoms



Ventral anterior cingulate

Torture Survivor > Non-Torture Survivor



Bilateral hippocampus

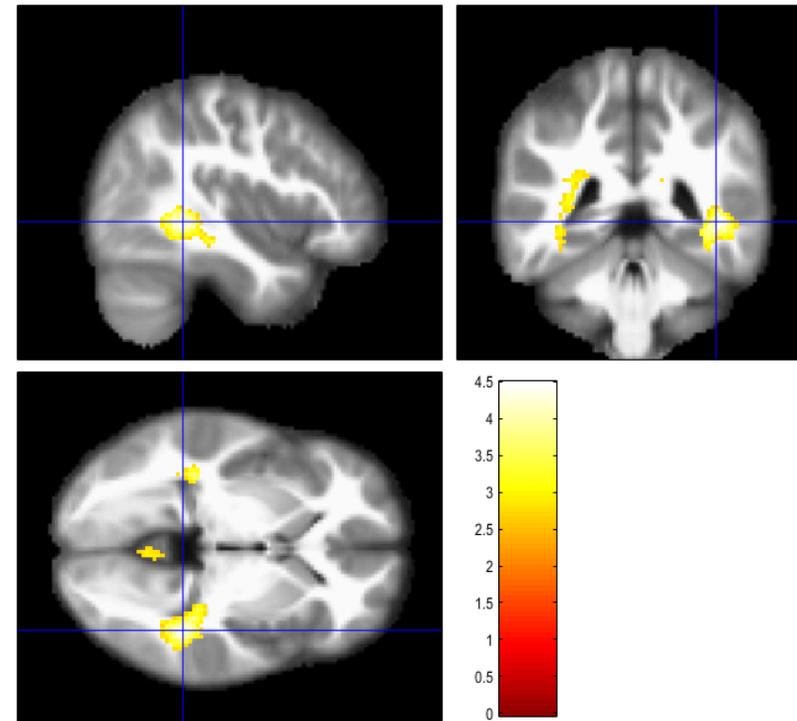
P<.05 FWE-corrected

Correlates with Hyperarousal

Torture Survivor cohort only

No correlates

Non-Torture Survivor > Torture Survivor group



Bilateral hippocampus, Right cluster parahippocampal
gyrus fusiform gyrus

P<.05 FWE-corrected

Correlates with Re-experiencing and Dissociative Symptoms

*No significant group differences or correlates within the
torture group*

Discussion

- Torture may have a long term impact on fear systems in the brain
 - This impact is related to the severity of torture exposure
 - This effect is irrespective of current levels of post-traumatic stress symptoms

Discussion

- Torture may have a long term impact on fear systems in the brain
 - This impact is related to the severity of torture exposure
 - This effect is irrespective of current levels of post-traumatic stress symptoms
- Reflective of emotion over-modulation neural model of PTSD observed in dissociative subtype of PTSD (Lanius et al., 2010)
 - This neural profile was not associated with active emotional numbing or dissociative symptoms
- Could makes post-trauma adjustment and recovery period very difficult

Discussion

- Traumatized refugees with and without torture exposure appear to display different neural correlates with PTSD symptom clusters
- Torture survivors:
 - Neural correlates of avoidance – right anterior insula
 - Neural correlates of emotional numbing – bilateral hippocampus, reduced vACC
 - Neural correlates of arousal – *diminished* bilateral hippocampus/fusiform gyrus
- Re-experiencing and dissociative symptoms – no group differences or significant correlates
- Neural model of PTSD may be different amongst survivors of torture
- May be important to consider the severity of the trauma or trauma dosage in neural models of PTSD

What is culture?

- Framework for understanding the self in the world
- Information system shared by a group, facilitating survival and deriving meaning from life (Kitayama & Juang, 2013)
- Reinforced practices of cultural groups impact on the psychology of the individual (Kitayama & Uskul, 2011).
- Results in a diversity in ways of thinking about, behaving and engaging in the world (Henrich et al., 2010).
- Cultures differ substantially in the conceptualization of the self (Markus & Kitayama, 2010).



Cultural Differences in Self-construal

Individualists

- ↘ Independent
- ↘ Autonomy
- ↘ Personal achievement
- ↘ Analytical thinking
- ↘ Western-based cultures
- ↘ Biased towards salient, focal objects and gist of scene

Collectivists

- ↘ Interdependent
- ↘ Relatedness
- ↘ Social harmony
- ↘ Holistic thinking
- ↘ East Asian and other non-Western cultures
- ↘ Biased towards contextual, peripheral, holistic processing

Culture and the Brain

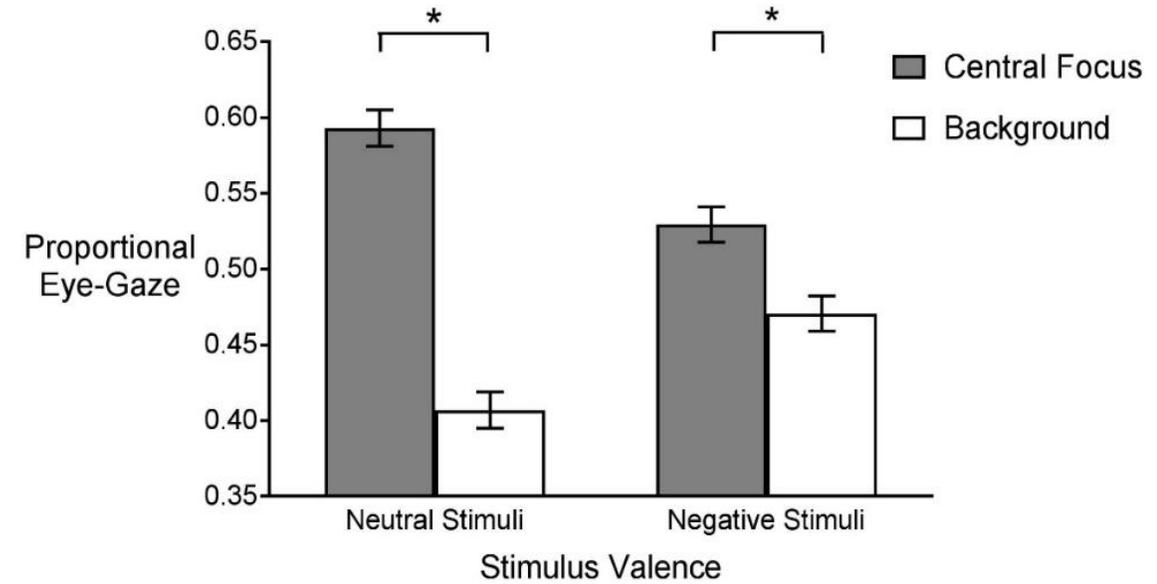
- Cultural variations in self-construal shape behaviour and brain function (Park & Huang, 2010; Han et al., 2013; Han & Ma, 2014).
- Visual perception, attention, memory, cognitive processes (Goh et al., 2010; Gutchess, 2009; Engelmann, 2013)
- Culture can play a significant role in the emotional lives of individuals (Ford & Mauss, 2015; Rogers et al., 2014; Mesquita, 2001; Jack et al., 2012; Chiao et al., 2009; Adams et al., 2010)
- Cultural factors modulate amygdala engagement to fear faces (Adams et al., 2010; Chiao et al., 2009; Derntl et al., 2012) and attentional deployment to face cues (Jack et al., 2012; Blais et al., 2008)

How might culture impact on emotion processing when event is highly threatening or traumatic?

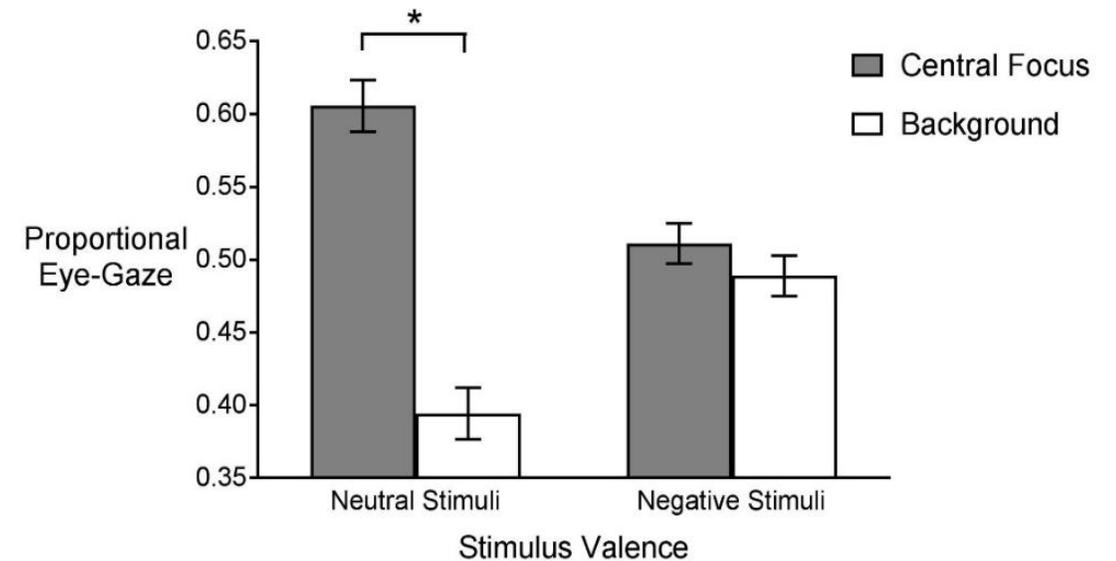


Group x Valence x Region interaction: ($F(1, 76) = 7.034, p = 0.010, \eta_p^2 = 0.085$).

Western European group (n=42)



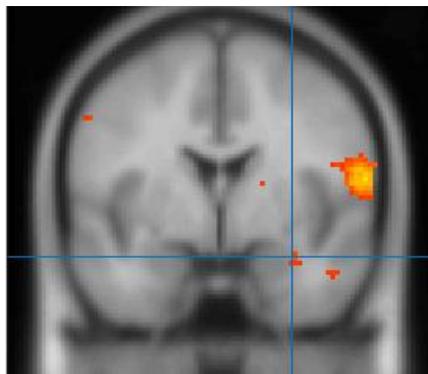
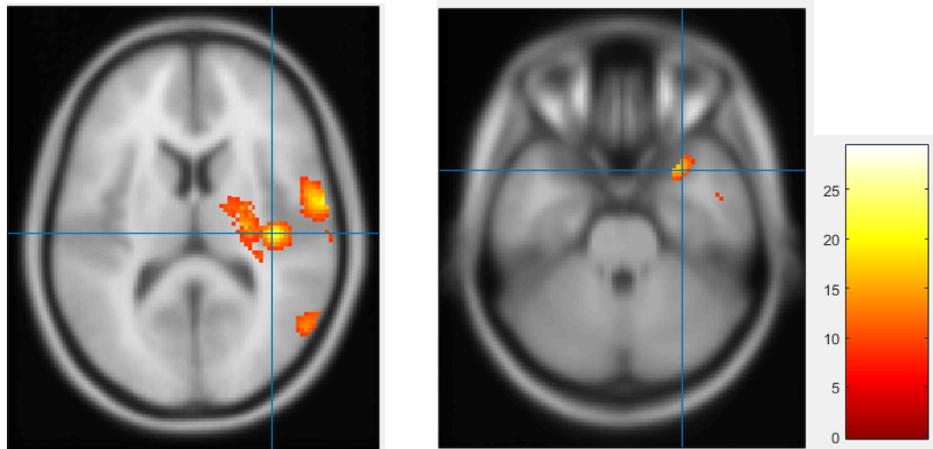
East Asian group (n=40)



Liddell, Belinda & Falon, Samantha (In Preparation): The impact of culture on the encoding & consolidation of complex emotional stimuli.

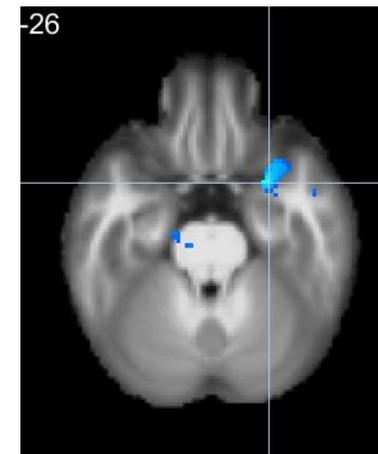
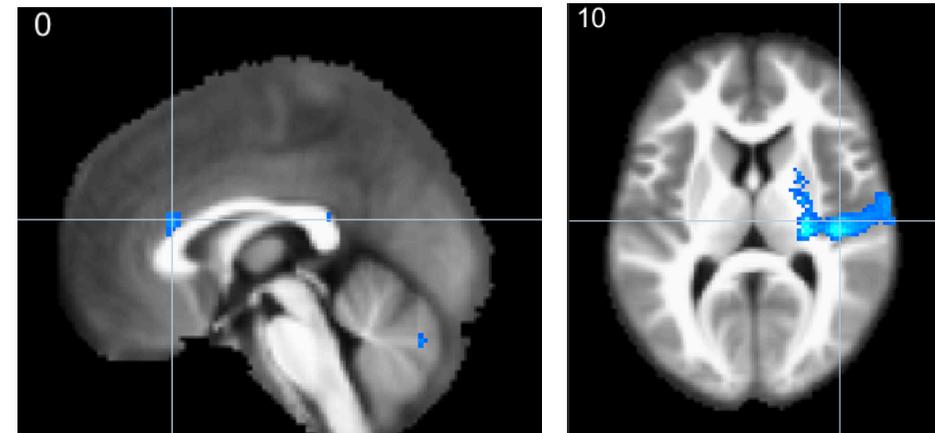
PTSD x Culture - Trauma-exposed Refugees

Interaction between PTSD and Self-construal Group



Insula/superior temporal cluster
Temporal pole
Amygdala/hippocampus

PTSD: Collectivists > Individualists



Dorsal anterior cingulate
Right insula extending to putamen and superior temporal gyrus
Right parahippocampal gyrus

What are we learning so far?

- Torture exposure may have specific effects on the brain
 - Prefrontal regulatory function
- It may be important to consider cultural factors in PTSD
 - Exposure to and perception of potentially traumatic events
 - Manifestation of PTSD symptoms
 - Recovery pathways

Future Questions

- How does torture and refugee trauma accord with neural models of PTSD?
 - Torture effects – specific to fear?
 - Connectivity between neural regions; whole brain systems engagement
- What is the inter-relationship between PTSD symptoms, trauma, culture, and current living difficulties and the impact on the brain?
- What are the mechanisms of resilience and recovery?

Acknowledgements

Website: www.rtrp-research.com



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Belinda Liddell: b.liddell@unsw.edu.au

Latest on Neuroscience and Trauma



Belinda Liddell

School of Psychology, UNSW Australia
Refugee Trauma and Recovery Program (RTRP)

b.liddell@unsw.edu.au

