Dealing with Unrelenting Threat: Translating the Lessons from the Neuroimaging Lab into Effective Treatment

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Collaborators

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Objectives

- Describe the effects of chronic early life trauma on psychopathology, attachment, and the self

Discuss 5 dimensions of consciousness that are often affected by trauma-related psychopathology:

- TIME (temporarility)
- THOUGHT (narrative)
- BODY (embodiment)
- EMOTION (affect)
- INTERSUBJECTIVITY

Discuss the role of the reptilian (subconscious) brain in the dimension of body, emotion & intersubjectivity
Psychiatric Comorbidity of Chronic Early Trauma

- Borderline Personality Disorder
- Dissociative Disorders
- Eating Disorders
- Dissociative Disorders
- Substance Use Disorders
- Somatisation Disorders
- Dissociative Disorders
- Depression Disorders
- PTSD
- Panic Disorders
- Anxiety Disorders
- Borderline Psychoses
- Early Trauma
- Attachment
- Common Denominators
- Dysregulation

Fraser, 1998
How Do We Develop Adequate Emotion Regulation Capacities?
The Attachment Relationship: A Prerequisite for an Adequate Window of Emotional Arousal
Optimum Zone of Emotional Arousal

**Hyperarousal**

- Unable to think and react rationally
- Unable to stand back and reflect
- Poor social engagement

**Optimum Arousal Zone**

- Optimum social & work functioning

**Freezing/Numbing**

DISSOCIATION

Ogden & Minton
The more repetitive the traumatic experience or the attachment dysregulation, the greater likelihood of developing severe emotion dysregulation, altered states of consciousness, and dissociation…
“Extreme states induced by stress and trauma are robustly different on state-defining variables (i.e., dissociated) from normal states of consciousness. The more severe the trauma, at least on certain indices, the greater the likelihood that an individual will be driven into an altered state of consciousness. Chronic or repetitive trauma leads to a greater number of altered states, which coevolve with time.” (Putnam, 1996, p. 176)
Four Dimensions of Consciousness Affected by Psychological Trauma

- **Time**: Experience of “now” (continuous transition between immediate past, present, and future)
- **Thought**: “Story-like” structural organization of consciousness (content, plot, narrator)
- **Body**: Thoughts, feelings, and actions originate from the body
- **Emotion**: Refers to valence, arousal, and distinct emotional feelings

Dan Zahavi & Evan Thompson (2007); Frewen & Lanius, 2015
Dissociative
Infrequency
Thought
Body
Emotion
Repeated/Developmental TE
Flashbacks-Reliving, Fragmentation
Time
Intrusive Recall, Reminder Distress
Voice-hearing
Thought
Negative Self-Other-Referential Thinking
Depersonalization
Body
Physiological Hyperarousal
Emotional Numbing, Compartmentalized Emotion
Emotion
General Negative Affect
Frewen & Lanius, 2015
Episodic memory differs from other kinds of memory in that its operations require a self. It is the self that engages in the mental activity that is referred to as mental time travel: there can be no travel without a traveler...
Mental Time Travel and Absorption in Recall is ‘Partial’. The “I”-Ego resides in the Present Self. Attention is directed, by choice, from Present Self to Past Self. The experience is of being in the present, and remembering the past (autonoesis). Awareness of Present Self is thus maintained; the representation of the Present Self outweighs that of the Past Self. Referring to ‘mental time travel’, in effect, the present self travels back to visit a past self. Considered part of normal waking consciousness.

Mental Time Travel and Absorption in Recall is ‘in Full’. Recall is not by choice but typically prompted by an external event matching a Past Self State and bypassing a weakened representation of Present Self. The “I”-Ego now resides as if in the Past Self, and attention is directed from Past Self to itself, with Present Self unattended. The experience is thus of being in the past. Awareness of Present Self is reduced; the representation of the Past Self outweighs that of the Present Self. In effect, referring to mental time travel, “there can be no travel without a traveler”.
Functional Connectivity Analyses [-14 -16 4]
CONTROL (n=11) versus Flashback/Reliving (n=13)

Control > PTSD

PTSD > Control

Lanius et al., AJP, 2004
Clinical Implications

- **PRESENT CENTERED THERAPIES:**
  Strengthening the self (e.g., building of safe relationships, including the therapeutic relationship, attachment resources, grounding skills, resource building, positive imagery, increasing positive affect tolerance, increased capacity for emotion regulation)

- **PAST CENTERED THERAPIES:**
  Exposure based treatments
Present vs Past Centered Therapies

Effects for present centered therapy was similar to a evidence-based trauma focused treatments (Frost et al., 2014; King et al., 2016)

Mindfulness based treatments are also showing efficacy for PTSD (e.g., Heffner et al., 2016; Frewen et al., 2015; Garland et al., 2015)
1st Person Perspective: Thoughts
Non-Dissociative

2nd Person Perspective: Voices
Dissociative

I hate you
I hate you
I hate myself
Dissociative Change in Narrative Perspective

• No longer is person the sole orator of his or her lived experience; another narrative voice(s) also speaks inside his or her head.

• The tale of one’s moment-to-moment phenomenal experience becomes shared among several speakers, a group conceivably differing in terms of interpretation (e.g., as evaluating an event as good vs. bad), emphasis (e.g., what is worthy of one’s attention), affect (e.g., negative vs. positive), goals (e.g., what choices one should make), and sense of time (e.g., present vs. past).
Fragmentation of the Self
Voice Hearing and Dissociation

Strong relationship between voice hearing and dissociation ($r=0.52$) (Pilton et al., Clinical Psychology Review, 2015)
Differentiating Psychotic Disorders from Dissociation

• Individuals with dissociative disorders were
  – more likely to experience voices before reaching adult age
  – more likely to experience three or more voices
  – were more likely to experience both child and adult voices (individuals with schizophrenia experienced almost exclusively adult-age voices)

Dorahy et al. (2009)
Working with the internalized voice of the perpetrator...
Toward Self-Compassion: Creating ‘Secure Attachment Relationships’ Between Different Parts of the Self
“The Body Keeps the Score.”

Bessel van der Kolk
Disembodiment and the Stress Response
Dissociative Status

Defense Reaction

Baseline Arousal

Hyperarousal & Hypervigilance Responses

Tonic Immobility

Depersonalization & Derealization Responses

Unresponsive Immobility

Fight or Flight Response

Active Defense
Sympathetic Dominance

Unresponsive Defense
Parasympathetic Dominance

Dissociative Status

adapted from Schauer & Elbert, 2010; Kozlowska, 2015
See also Porges Polyvagal Theory
The Body During Fight, Flight, Freeze, and Shut Down
Fight, Flight, Freeze, Shut Down and the Reptilian Brain
The Reptilian Brain: The Subconscious Brain

Hardwired Defensive Responses

MacLean, 1990
The Reptilian Brain and the Innate Alarm System

Lanius et al., *Current Opinion in Psychology*, 2017
Periaqueductal Gray (PAG)

- Small tube-shaped region in midbrain
- Critical for autonomic regulation and for defensive responses
- Crucial role in basic emotional systems
- Comprised of multiple subdivisions that vary in function
PAG Subdivisions

(Bandler et al., 2000; adapted by Linmann et al., 2012)
Dorsolateral PAG Connectivity

A. Dorsolateral > Ventrolateral PAG Connectivity

PTSD

Anterior Insula  Supp Motor Area  Postcentral Gyrus

B. Dorsolateral > Ventrolateral PAG Connectivity

PTSD Dissociative Subtype

Precentral Gyrus  Postcentral Gyrus

DL-PAG connectivity with structures that aid in ‘fight or flight’ defensive responses

(Butler et al., 2007; Tegeler et al., 2017; DeMorree et al., 2016)

Harricharan et al., 2016
Dissociative PTSD: Greater Ventrolateral PAG Connectivity

Left TPJ  Right Rolandic Operculum

Increased Depersonalization

(Blanke & Arzy, 2005; Muscatelli et al., 2010;)

Harricharan et al., 2016
Clinical Management of Freezing Responses
Beware of freezing of the breath during freezing responses
Continuous Breathing: Ocean Breathing
The midbrain periaqueductal gray (PAG) organizes basic survival behavior, which includes respiration. How the PAG controls respiration is not known. We studied the PAG control of respiration by injecting d,l-homocysteic acid in the PAG in unanesthetized precocillarily decerebrated cats. Injections in different parts of the PAG caused different respiratory effects. Stimulation in the dorsomedial PAG induced slow and deep breathing and dyspnea. Stimulation in the dorsolateral PAG resulted in active breathing and tachypnea consistent with the respiratory changes during fright and flight. Stimulation in the medial part of lateral PAG caused inspiratory apneas. Stimulation in lateral parts of the lateral and ventrolateral PAG produced respiratory changes associated with vocalization (mews, alternating mews and hisses, or hisses). d,l-Homocysteic acid injections in the caudal ventrolateral PAG induced irregular breathing. These results demonstrate that the PAG exerts a strong influence on respiration, suggesting that it serves as the behavioral modulator of breathing.

Key words: midbrain; emotional breathing control; pattern generation; periaqueductal gray; brainstem; respiration
Deep, Paced Breathing & Heart Rate Variability
Heart Rate Variability (HRV)

- HRV reflects variation in the time interval between heartbeats
- Indicative of well regulated parasympathetic activity (HF-HRV- Bernston et al, 1997)
- Enables the organism to respond flexibly to environmental changes
To do so, the autonomic nervous system is separated into two branches, normally behaving in a balanced fashion:

1) the parasympathetic nervous system (PNS) associated with restorative and vegetative functioning (BRAKE)

2) the sympathetic nervous system (SNS) linked to energy mobilization (ACCELERATOR)
Heart Rate Variability (HRV) (con’t)
Heart Rate Variability (HRV) (con’t)

- Decreased HRV has been shown to be associated with a blunted ability to respond flexibly to environmental changes (Gillie and Thayer, 2014; Melzig, et al., 2009; Thayer and Lane, 2000)

- Decreased HRV has been shown to be associated with mental and physical health (e.g., PTSD, depression) (e.g., Cohen et al, 1997; Hauschildt et al, 2011; Stein, et al., 2000; Thayer and Brosschot, 2005)
The Effects of Conscious & Subconscious Triggers on HRV
Innate Alarm System

Lanius et al., *Current Opinion in Psychology*, 2017
Important to be aware of subconscious triggers in our clients...
Brain Regions (Central Autonomic Network) Associated with Autonomic Function

- Brain regions associated with HF-HRV: Amygdala, medial prefrontal cortex, cingulum, insula, and PAG (Thayer et al. 2012; Beissner et al. 2013; Thome et al., 2016) are core regions involved in autonomic regulation.
Central Autonomic Network and Autonomic Function in PTSD at Rest

**No association** of HRV with functional connectivity of Central Autonomic Network regions in PTSD

Lack of top–down Central Autonomic Network regulation of autonomic responses

Thome et al., 2016
Loss of Top Down Control: Disconnection of Mind and Body
Clinical Implications: Restoring Mind/Brain/Body Connections
Mind/Brain/Body Synergy
Consciousness of Emotion

Emotional Numbing, Compart-mentalized Emotion
Consciousness of Emotion

• Theorists have increasingly pointed out the significant role likely played by emotional processing in the across-species evolution of consciousness (e.g., Panksepp, 2008).
• Active and passive defensive responses
• Important role in all basic emotional systems (fear, rage, seeking, panic)
• Consciousness
<table>
<thead>
<tr>
<th>Basic Emotional Systems</th>
<th>Key Brain Areas</th>
<th>Key Neuromodulators</th>
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<tbody>
<tr>
<td>General Pos. Motivation SEEKING/ Expectancy System</td>
<td>Nucleus Accumbens – VTA, Mesolimbic and mesocortical outputs, Lateral hypothalamus – PAG</td>
<td>DA (+), glutamate (+), opioids (+), neurotensin (+), orexin (+), Many other neuropeptides</td>
</tr>
<tr>
<td>RAGE/ Anger</td>
<td>Medial amygdala to Bed Nucleus of Stria Terminalis (BNST). Medial and perifornical hypothalamic to PAG</td>
<td>Substance P (+), Ach (+), glutamate (+)</td>
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<tr>
<td>FEAR/ Anxiety</td>
<td>Central &amp; lateral amygdala to medial hypothalamus and dorsal PAG</td>
<td>Glutamate (+), DBI, CRF, CCK, alpha-MSH, NPY</td>
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<tr>
<td>LUST/ Sexuality</td>
<td>Cortico-medial amygdala, Bed nucleus of stria terminalis (BNST) Preoptic hypothalamus, VMH, PAG</td>
<td>Steroids (+), vasopressin, &amp; oxytocin, LH-RH, CCK</td>
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<tr>
<td>CARE/ Nurturance</td>
<td>Anterior Cingulate, BNST Preoptic Area, VTA, PAG</td>
<td>oxytocin (+), prolactin (+) dopamine (+), opioids (+/-)</td>
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<tr>
<td>PANIC/ Separation</td>
<td>Anterior Cingulate, BNST &amp; Preoptic Area Dorsomedial Thalamus, PAG</td>
<td>opioids (-), oxytocin (-) prolactin (-), CRF (+) glutamate (+)</td>
</tr>
<tr>
<td>PLAY/ Joy</td>
<td>Dorso-medial diencephalon Parafascicular Area, PAG</td>
<td>opioids (+/-), glutamate (+) Ach (+), cannabinoids, TRH?</td>
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Damasio et al., 2000
Consciousness Without a Cortex

Figure 9. The reaction of a three-year-old girl with hydranencephaly in a social situation in which her baby brother has been placed in her arms by her parents, who face her attentively and help support the baby while photographing.

Merker, 2007
Increased connectivity in areas involving emotional reactivity such as **amygdala, anterior cingulate cortex, insula, cerebellum** (Adolphs et al., 1994; Bush et al., 2000; Stein et al., 2007; Turner et al., 2007)

Implications for therapy...
How can we regulate emotions?
How can we regulate emotions?
Reappraisal

I have a lot of excitement in my life. I used to call it tension, but I feel a lot better now that I call it excitement.
I know that it was not my fault, but I can't stop feeling it...
How can we regulate emotions?
Yoga
(Trauma-Sensitive)
Sensorimotor Therapy

Listen to your body.
Comprehensive Resource Model

Schwarz et al., 2017
Neurofeedback: An Adjunctive Treatment to Aid in Both Bottom Up and Top Down Regulation?

Nicholson et al., Neuroimage Clinical, 2016
Neurofeedback

Before NFB

• Increased amygdala complex connectivity to mibrain/brainstem areas (PAG; defense cascade)

After NFB

• Shift in amygdala complex connectivity to mPFC and emotion regulation regions
• Associated with decreased arousal/↑calmness

Nicholson et al., 2016
The four dimensions of consciousness and the sense of self...
An organism must be able to experience its own existence as a sentient being before it can experience the existence and salience of anything else in the environment...

Craig, 2009
Without a Self there is no Other...
Isolation and Estrangement...
Mentalizing: Allowing Experiences of Time, Thought, Body, and Emotion to be Shared between Two Individuals
Our eyes are said to be the mirror of our soul: eye-contact allows us to get an idea of what others have in mind, what they think, feel, or intend to do (Baron-Cohen, 1995; Tomasello & Carpenter, 2007).
Tim

- **Interviewer:** What would it be like to make eye contact?

- **Tim:** It feels, really scary. I feel like they’re going to see a kind of stain on my soul. I feel a sense of shame about being in the situation in Vietnam, and I also feel shame about some of the things that I witnessed and I didn’t do anything about—case in point, watching idly while they threw a grenade in a hole with a guy and knowing full well what the outcome of that was going to be...
The Neurobiology of Eye Contact
Eye Contact and the Innate Alarm System

Superior Colliculus/Periaqueductal Grey

Steuwe et al., 2015
Direct Gaze > Avert Gaze (Angry, Happy and Neutral)

Steuwe et al., SCAN, 2012
Eye Contact & The Innate Alarm System

NO ACTIVATION OF HIGHER CORTICAL REGIONS IN PTSD

Superior Colliculus/Periaqueductal Grey

Steuwe et al., SCAN, 2014
Implications for treatment, obtaining social support, and the intergenerational transmission of trauma...
Healing the Traumatized Self: The Rebirth of the Self
The goal of psychotherapy is to help the traumatized individual establish a sense of self that is integrated across time, thought, body, and emotion and thereby is capable of the agentic pursuit of joy, pleasure, and triumph both within oneself and within relationships.
4D-Model and Sense-of-Self: From Trauma to Recovery

Not integrated across time, thought, body, and emotion

I am in the past...
I am outside my body, and my body does not belong to me...
My thoughts and voices take control...
I can’t feel / I don’t know what I’m feeling, feel too much / too little...

SELF TRAUMATIZED
“I was running on terror, and the only way that I can describe it, in retrospect, was that it was a kind of animal survival psyche. My sense of self was pretty undefined and diffuse, as if the nerve endings had no stopping place, and so without a skin or without a boundary, and without the other which creates that boundary, there isn’t a self.”
4D-Model and Sense-of-Self: From Trauma to Recovery

I am in the past...

I am outside my body, and my body does not belong to me...

My thoughts and voices take control...

I can’t feel / I don’t know what I’m feeling, feel too much / too little...

SELF TRAUMATIZED

I am in the present...

I am in my body and it belongs to me...

I own and am in control of my thoughts...

I can feel, and know what I’m feeling...

SELF RECOVERED
“It just happened that, there I was, established in that universe as a separate human being, not particularly unique, sort of ordinary and with other human beings who were living their lives out too. This was all like, miraculous, and I could only know it was miraculous in the absence of all the fear.... I could make eye contact, it didn’t hurt anymore - because it had been physically painful to make eye contact with another human being - that just was not an issue anymore...
...I would look at myself in the mirror (laughs)...hadn’t done [that] before (laughs)... I don’t know that I can say too much more about it, except that in the absence of abiding terror, a self can occur. A self *does* occur, and self-in-relationship occurs, because the other comes into view: smelled and felt and known. And then the other is known as having their own inherent self”.
THANK YOU!