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Understanding the Neurobiology of Complex Trauma

Building a framework for effective practice with children, young people and their network of relationships.

Virtual Classroom



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The Australian Childhood Foundation acknowledges the Aboriginal and Torres Strait Islander peoples as the traditional custodians of this land and waters. We pay our respects to their elders past and present and to their children who are the leaders of tomorrow. We acknowledge their history and living culture and the many thousands of years in which they have raised their children to be safe and strong.



2



Learning together online

- Participation welcome
- Cameras on
- Mute yourself when not talking
- Hands up or use the chat button if you have questions
- Please use headphones if children are in your training space
- Confidentiality



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Safety

The content of this training can evoke strong emotions and may trigger personal experiences of trauma.

Please be mindful of your own wellbeing during this training and if you need support please ask the facilitator.

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Learning outcomes

- ✓ Learn in detail about brain/body development through childhood and adolescence,
- ✓ Understand the ways that trauma shapes children and young people's states, needs and experiences,
- ✓ Develop creative and evidence based approaches and practice strategies to enable children and young people to communicate and transform their experiences of trauma,
- ✓ Build approaches that resource change across all environments in which children and young people live, learn and relate.

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Supporting Trauma

HEALTHY TRAUMA INFORMED AND INTEGRATIVE APPROACHES

CONNECTION TO SELF
CHILD

I need to FEEL SAFE

I need to MAKE MEANING of my world

SAFE, PROTECTIVE AND CHILD FRIENDLY COMMUNITIES

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Holding the child at the centre...



[View image in fullscreen](#) [Download image](#) [Download image](#)

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I need connection to my CULTURE



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Culture is part of development

Our culture influences our brain development.
How has it influenced yours? Think about:

- Sense of safety
- Relationships
- Meaning making



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The Importance of Culture

A protective factor

Safety: Belonging
Relationships: Connection
Meaning making: identity

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The CHILD

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BRAIN DEVELOPMENT


and the impacts of trauma

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Brain development

- The brain develops through a mix of genetics and environmental factors.
- Key to this development are relationships
- The brain develops sequentially from the bottom up




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Neuronal connections

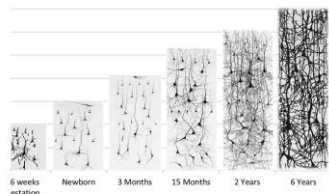
- The neural system has the ability for one neuron to communicate with up to 10,000 other neurons
- The newborn brain has approximately 100 billion neurons



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Neuronal development

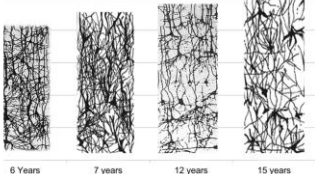


- Rapid growth occurs from birth to 6 years
- **Critical period** of development
- Healthy neuronal development occurs through **relationships, regulation, repetition**

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Neuronal development




6 Years 7 years 12 years 15 years

- Early years – period of **rapid growth**
- Followed by onset of puberty in which **synaptic pruning and formation of new neurons** occurs.

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Sequential brain development – building blocks




- The Thinking brain**
3-5 Years
- The Emotions and Memory Brain**
Birth - 4 years
- The Movement Brain**
Birth – 2 years
- The survival brain**
Pre birth to 8 months

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Brainstem - basic life functions

- Basic life functions
- First part of our brain to develop
- This is the most developed brain part at birth
- Responsible for our heart beat, breathing, sucking, temperature control, blood pressure




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Superior Colliculus

- Processes visual threats – looming objects identified by cells in the retina of the eye
- Retinal neuronal input received by Superior Colliculus which engages the body in **Avoidance and defensive behaviours**




A diagram of a human head in profile, showing the brain. The Superior Colliculus is highlighted in orange and circled with a red line. A red arrow points from the eye area towards the Superior Colliculus.

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Cerebellum- movement and balance

- Helps us to know where our body is in space
- Helps us with our posture and balance
- Helps us not to fall over and to control our movements
- Has its own connective pathways between the 2 halves- cerebellar vermis




A diagram of a human head in profile, showing the brain. The Cerebellum is highlighted in red.

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Diencephalon - sorting & sending centre

- This area of the brain develops mainly after birth
- It sorts out messages coming into the brain and sends them
- It uses hormones to send signals to body
- Hormonal signals tell your body what it needs, eg, food, water, love




A diagram of a human head in profile, showing the brain. The Diencephalon is highlighted in yellow.

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Limbic lobe- emotional gateway

- The part of the brain that helps us attach an emotion to an experience or memory
- This part of the brain is particularly involved with the emotions of fear and anger
- Also heavily involved in attachment processes
- This area develops mainly after birth




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Hippocampus – Brain’s historian

- Explicit memory system
- Develops approximately 2-3 years of age
- Provides context to memory and embeds long term memory




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Amygdala – smoke alarm

- Detects threat
- Develops from birth
- Learns by association
- Involved in implicit memory processes




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Cerebral cortex- complex thinking

- The largest part of the brain
- Associated with higher brain function such as thought and action
- Examples of functions:
 - Reasoning
 - Logic
 - Judgement
 - Voluntary movement




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The prefrontal cortex- executive function

- Responsible for executive functions, such as judgement, reasoning, and self awareness
- Final part of the brain to reach maturity in one's mid 20s
- Under reconstruction in adolescents from the age of approximately 12 years




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Medial prefrontal cortex

- Associated with perceptions of self and similar others
- Known as centre for mindfulness
- Involved in maternal bonding – the parent child dyad and inter-subjectivity




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Hemispheric integration

Left Hemisphere

- Evaluates language content
- Optimistic hemisphere
- Understands beginning, middle and end
- Learns from the past and expects the future
- Looks for patterns




Right Hemisphere

- In the present moment
- Eye contact
- Facial expression
- Tone of voice
- Posture
- Gesture
- Intensity
- Is mute
- Grasps the whole

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Corpus Callosum



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Lateral Brain development



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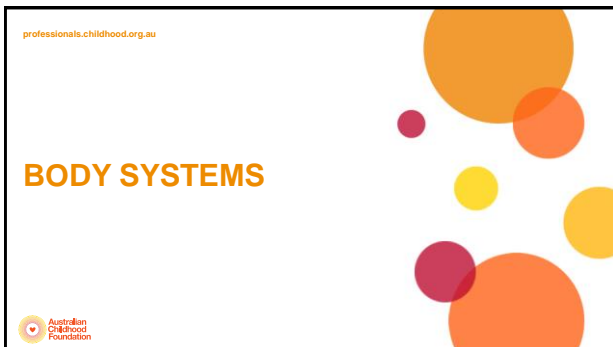
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Strategies for building healthy brain development

Brainstem & Diencephalon	Basic survival & sensory processing	Pacification or stimulation. Activities in the child's preferred sensory modality
Cerebellum	Coordination of movement	Using music, rhyme and movement activities
Limbic	Emotional processing	Building relational connection through plays, animals, games
Cortex	Thinking processes	Linking experiences and sensations to words and descriptions
Prefrontal cortex	Analytical and abstract thinking	Challenges and safe risk taking activities

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Oxytocin

Role in regulating maternal care behaviours:

- Critical for maternal behaviour – motivates the parent to care for his/her infant
- In several mammalian species, facilitates physical proximity and nurturant care

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The Parental Approach System: the role of hormones

oestrogen
prolactin
oxytocin

hypothalamus

self-defence system calmed

reward system sensitised

Dan Hughes

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Dopamine

- A neurotransmitter - plays a big part in **motivation and reward**
- 'Feel good' hormone – nearly all pleasurable experiences come from a release of dopamine – eating, sex, etc

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The role of Dopamine in mother-infant bonding

'A study group investigated the role of dopamine in mother-infant bonding and found that both mother-infant vocalization synchrony and maternal attunement were associated with higher dopamine concentration in brain structures connected to bonding'.

<https://www.medicalnewstoday.com/what-dopamine-mother-infant-bonding/>

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Cortisol

Can help:

- your body respond to stress or danger – **fight, flight, freeze, submit response**
- increase your body's metabolism of glucose
- control your blood pressure
- reduce inflammation

KEY:
 — irregular curve
 — normal curve

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Hypothalamic (Diencephalon) / Pituitary / Adrenal Axis

1. The hypothalamus secretes the hormone **corticotropin-releasing factor (CRF)**, which rouses the body.
2. CRF travels to the pituitary gland.
3. The pituitary gland secretes **adrenocorticotropic hormone (ACTH)**.
4. ACTH circulates in the bloodstream, traveling to the adrenal gland.
5. The adrenal gland releases **cortisol**, another hormone.
6. Cortisol stimulates many reactions in your body, including a rush of energy and alertness.

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HPA Axis

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8 senses

1. Visual
2. Auditory
3. Olfactory (smell)
4. Gustatory (taste)
5. Tactile System (touch)
6. Vestibular (sense of head movement in space)
7. Proprioceptive (sensations from muscles and joints of body)
8. Interoception (awareness of basic primary functions – hunger, toileting, breathing)

The diagram consists of seven circular icons arranged in two rows. The top row contains three icons: a blue eye labeled 'Vision', a green nose labeled 'Olfaction', and a red mouth labeled 'Gustation'. The bottom row contains four icons: a purple ear labeled 'Audition', an orange hand labeled 'Somatosensory', a pink figure with a tilted head labeled 'Vestibular', and a green figure with a tilted head labeled 'Proprioception'.

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Auditory - Ohm dad

A photograph showing a man with a beard and a blue cap kissing a baby on the forehead. The baby is lying down, and the man is leaning over them.

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Olfactory

A photograph of a baby in a grey patterned onesie sniffing a white cloth. The baby's face is close to the cloth. The background is a light-colored patterned surface.

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Activities to support body awareness



Round – straight	Light – strong
Sit – stand	Under – over
Small – large	Yes – no
Freeze – melt	In – out
Push – pull	Tall – short
Wide – narrow	Loud – soft
Left – right	Up – down
Hot – cold	Happy – sad
Fast – slow	Fast slow

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Holding the child at the centre




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TRAUMA



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What is Trauma?

Any single, ongoing or cumulative experience which:

- is a response to a perceived threat, usually to survival
- overwhelms our capacity to cope
- feels/is outside our control
- evokes a physiological and psychological set of responses based on fear or avoidance

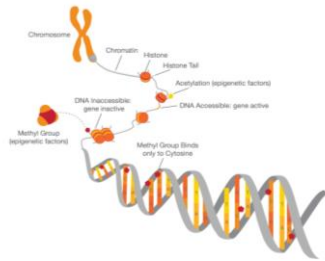


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Epigenetics

"The study of inheritable changes in gene function without the change in the DNA sequence"

Journal of Science




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Epigenetics



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Sequential brain development – disrupted by trauma

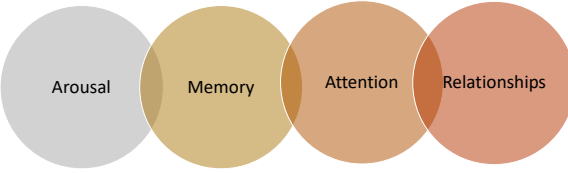


- The Thinking brain
3-5 Years
- The Emotions and Memory Brain - Birth to 4 years
- The Movement Brain
Birth – 2 years
- The survival brain
Pre birth to 8 months

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Trauma impacts



Arousal Memory Attention Relationships


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Arousal - Affect dysregulation

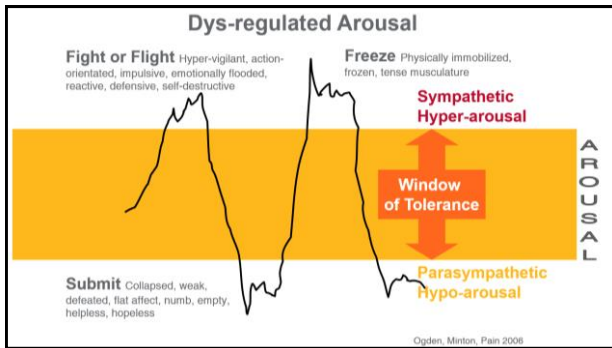
Extremes of affect state:

- **Terror** replaces fear
- **Despair** replaces sadness
- **Rage** replaces anger

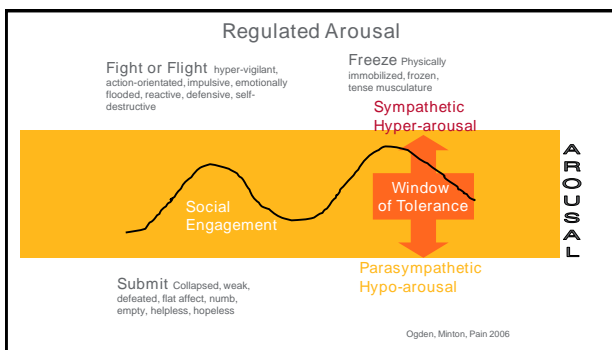


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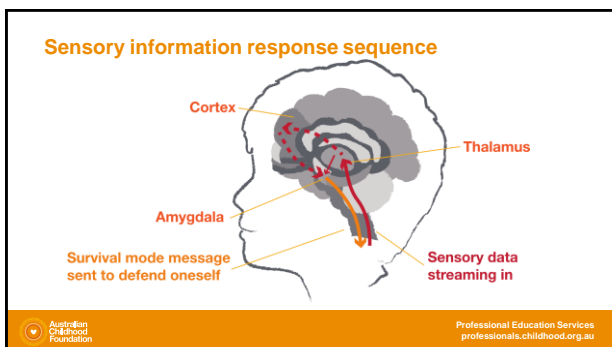
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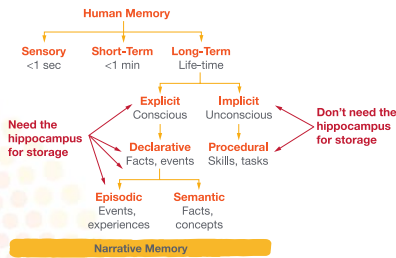
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Strategies for healing... Desktop drumming



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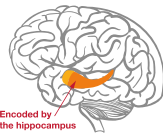
Memory



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Encoding memory

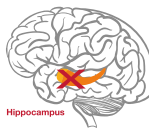
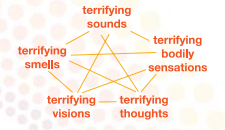
- Implicit Procedural Memory**
 - Non-verbal
 - Separate fragments
 - Emotional/sensational
 - Outside conscious awareness
- Explicit Memory**
 - Develops at 2-3 years of age
 - Consciously retrieved
 - Eg. Autobiographical story



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Encoding traumatic memories

- Implicit Procedural Memory**
 - Non-verbal
 - Separate fragments
 - Emotional/sensational
 - Outside conscious awareness
- Explicit Memory**
 - Develops at 2-3 years of age
 - Consciously retrieved
 - Explicit memory systems can become shut down when trauma is present



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Implicit memory



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Attention – impacts of trauma

- Affects sustained and focused attention
- Focus remains on the perceived threat
- Difficulty in focussing on task at hand, listening to instructions or following directions
- Shark music – always playing



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Working with attention issues

- **Check yourself** – your body language, tone of voice, facial expressions
- **Check the environment** – reduce overstimulation
- **Know the child** and their triggers
- **Use relationship** to help the child regulate – co-regulation
- **Provide sensory tools** that the child can ground with
- Try music, song, rhythm, to calm the brain stem and reduce bottom up hijacking by the survival brain

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Neuroplasticity



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Holding the child at the centre...



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I need to feel SAFE...

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Safety principles

Safety is embedded in our physiology
 Safety is a relational experience
 Child abuse is a deep violation of a child's sense of safety

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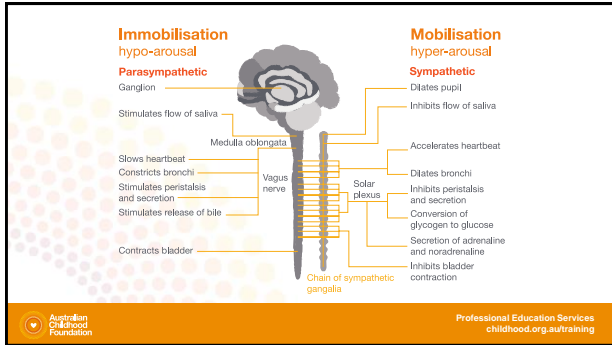
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A hierarchical nervous system response

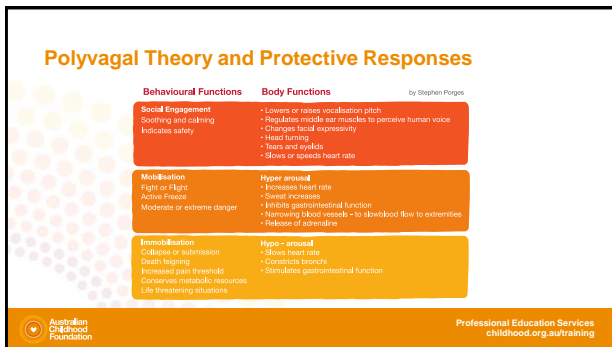
<p>Safety</p> <p>S= social engagement</p> <p>S= mobilised play</p> <p>S= immobilised for sexual intimacy</p>		<p>Danger</p> <p>D= social engagement</p> <p>D= mobilised fear responses to threat</p> <p>D= immobilised responses to threat</p>
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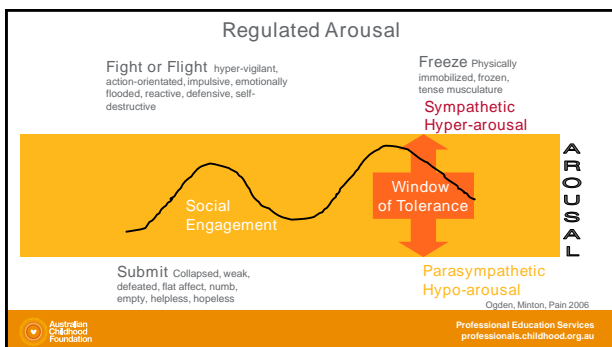
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Strategies for healing - Creating safety

Environment

Proximity

Eye Contact

Facial expressions

Tone of voice

Posture and gestures

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I need safe and attuned RELATIONSHIPS

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The right hemisphere in infancy

• Normatively develops in an integrated fashion through healthy attuned, co-regulatory relationships in the primary years of life.

Attunement

Exploration

Responsiveness/Modulation

Self regulation

Acknowledgement/Validation

Self awareness

Another's self experience

Relational experience

Self experience

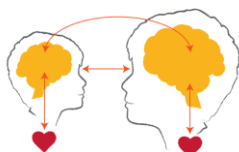
Connection

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The right hemisphere in relationship


- These primary relationships contribute to:
- stored internal working models of primary relationships recorded in the right hemisphere
- the perception of emotion in self and others, enabling empathy and humour.



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Still face



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Rupture and repair

What you did is not ok, but you're still a good person and our relationship is still strong.'



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Meaning making

How children understand and make meaning of their world often occurs through what is reflected back to them through their interactions with significant adults.


If adults respond to the child's behaviour in a punitive way, it reinforces negative schemas and stories that the child has developed about themselves.

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Self Concept: Internal working models


	Positive internal working model	Negative internal working model
View of self	I am lovable I am worthy	I am unlovable I am unworthy
View of the world and relationships	Others are responsive Others are loving Others are interested in me Others are available to me The world is relatively safe	Others are unavailable Others are neglectful Others are rejecting Others are unresponsive The world is unsafe

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Trauma response patterns

- To cope with trauma children use initial adaptive responses to survive
- This is reasonable as a once off occurrence, but, if they continue they can become maladaptive patterns of behaviour
- These responses will be different for an individual child at different developmental stages
- Often a combination of appropriate developmental behaviours and maladaptive patterns of behaviour emerge

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Behavioural – narratives of trauma

- Behaviour tells a story!
- Traumatized children's behaviour can be difficult and complex for parents, teachers and carers to understand, manage and shape
- However, it is functional and almost always makes sense given their specific experiences of trauma
- Children's behaviour is the manifestation of the impacts of trauma outlined in the previous sections

Sometimes when we are angry, there are other emotions under the surface

Icebergs are giant floating pieces of ice found in the coldest parts of the ocean. What you can see from above is just a tiny part. Most of the iceberg is hidden under the surface.

Angry Straight Ahead! Watch Out!

Embarrassed Annoyed Rejected Scared Let's go deeper! Guilt Alone Shame Grief Dismal Insecure Disappointed

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Common themes

- "attention seeking" needing/seeking connection
- "manipulative" inability to trust
- "inattentive" worried and preoccupied
- "disruptive" difficulty asking for help

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Meaning making

In making meaning we want the child to understand who they are despite their experiences of trauma

And for them to know they are ok, they are loved, they are accepted no matter what trauma symptoms are being expressed.

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Holding the child at the centre...



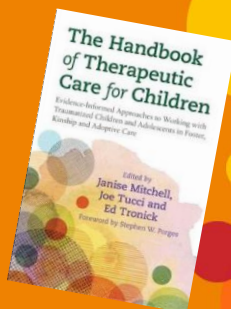
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A valuable resource

- Includes chapters from:
- Martin Teicher
- Ed Tronick
- Allan Schore
- Bruce Perry
- Dan Hughes & Jon Baylin
- Kim Golding
- Cathy Malchiodi
- Joe Tucci
- Janise Mitchell
- Glenda Kickett
- Noel Macnamara



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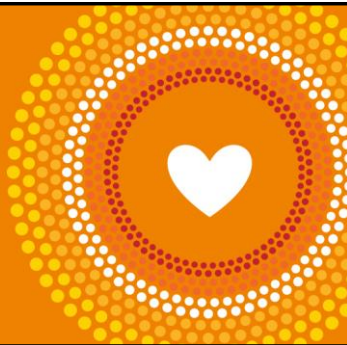
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